

HOME WORKSHOP PLANS AND HINTS - 350 PICTURES



NEW CAR ABOLISHES REAR SEAT "BOUNCING"



engineers remove cause of "pitching" and bumps ...give New Plymouth its famous Floating Ride

For YEARs, there wasn't much comfort friding in the rear seat of any car. Even small road bumps would make the car "gallop"... and give back-seat passengers a good shaking-up.

Then, after years of study, engineers discovered a new principle—which was introduced in the famed "Airflow" cars.

Seats and engine were moved forward, equalizing the weight on front and rear springs. Now the same principle is used in one of the lowest-priced cars on themarket: the beautiful, new Plymouth.

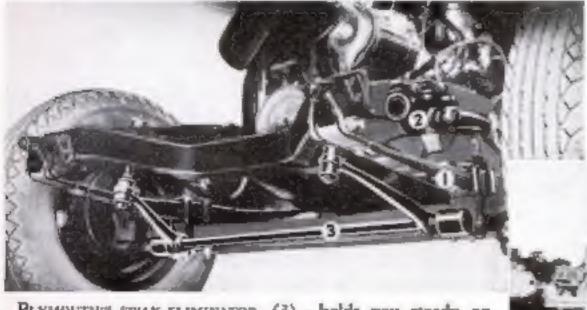
In addition, a new type of spring has been perfected—with tapered leaves, and made of special Mola steel. And a sway-eliminator has been added at the front...to hold the car steady and upright on curves.

Gives famed "Floating Ride"

The result is a miraculously smooth, restful ride. There is no bouncing or pitching. The back-seat rides like the front. You can hardly believe you're riding in a low-priced ear!

Be sure to ride in "All Three" leading low-priced cars...and just compare the others with Plymouth's Floating Ride!

Ask your Chrysler, Dodge or De Soto dealer about the new Plymouth...now only \$510 and up, list at factory, Detroit. Official Chrysler Motors Commercial Credit Plan offers convenient terms.



PLYMOUTH'S SWAY-ELIMINATOR, (3)—holds you steady on curves, even at high speeds. Note, also, (1)—Plymouth's new tapered leaf springs; and (2)—double-action shock absorbers.

RAYMOND J. BROWN, Editor
ARTHUR WARRIAND, Home Workshop Editor
Alben P. Armagnac, Associate Editor
Sydney Oxberry, Art Editor

POPULAR

VOLUME 127 · NUMBER 1
15 Cents a Copy · \$1.50 a Year

Published Monthly by
Popular Science Publishing Co., Inc.,
153 Fourth Ave., New York

TABLE OF CONTENTS for JULY, 1935

Patent No. 2,000,000—a Milestone in American Invention Aubrev D. MacFadyen reviews Uncle Sam's business of passing on new discoveries	п
New Studies of Bones Show How We Grow	14
Scientific Shooting Gallery Reveals Secrets of Gunpowder	20
Amazing Feats of Bloodhounds	24
Realistic Models of Prehistoric Men Made by New Casting Process Andrew R. Boone discovers an unusual enterprise under way in a taxidermist's shop	30
Strange Pranks of the Wind	38
Daring Riders Thrill Crowds with Polo on Motor Cycles Walten E, Bunton explains the technique of an exciting machine-age sport	12
Giant Lights Paint Sky to Work New Magic	49

July 1934, but 127 No. 1. Popular Science Mentility in pulsitioned manning at 3.1 Pourch Avenue. New York, N. Y. In this Popular Science Publishming to Inc. A. L. Cafe, Projected and Trensurer: R. C. Wilson, Vice President; F. W. House, New York Trensurer: R. C. Wilson, Vice President; F. W. House, New York July 1948, at the Pout Office at New York under the act of March I. 1879, additional enter at New York under the act of March I. 1879, additional enter as second case matter in Dayton, Ohio, Entered as econd-class and terral the Post Office Department, Canada, Petrolod in C. S. Cuperball, 1833, by the Popular Science Publishing Un, inc. canada, Transparent of the Popular Science Publishing Un, inc. canada, Transparent of the best popular for formula, 22. Suffurnities most published date. Be sure in give limits in ad change of address four weeks in echanics of the manning near to the reprinted mixing permission. The estimate are not reasonable for unantification and respited in the manning pour potential for sometime to proceed the presenting numerous attains of applied wiener. Popular Science Monthly searches for such celling mannerous states of new problem of septimel wiener. Popular Science Monthly arrivers for such celling whereas in never authorized.

FEATURES AND DEPARTMENTS

Home Repairs Made Easy		6
Our Readers Say	_	8
The Man with the Net	_	33
Marvels of the Earthworm		40
Spectacular Chemical Tricks	ì	44
Here's the Answer		48
Kinks for Radio Experimenters		53
Portable Public-Address System		54
Tricks Add to Driving Comfort	į,	56
The Home Workshop		57
Timely Hints for Car Owners		72

Coper Design by EDGAR F. WITTMACK

AUTOMOBILES

Þ	AUTOMOBILES	
	Traffic Lights for Auto Recers .	18
	Shack Carried on Auto	19
	Test Roads in Colors	32
	Reflectors Mark Highway Corb .	33
	Werch in Ignition Key	33
	AVIATION	
	Dry Dock for Seaplanes	28
	Fuel May Boost Plane Speed .	28
	Dolly Carries Propellers	32
	Globe Stabilizes Helicopter	35
	Steam Wind Vone Aids Fliers .	36
	ENGINEERING	
	River Put under Bridge	27
	Highest Mon-Made Waterfall .	32

Breaks Let Bridge Expand . .



Making Money With Your CAMERA

Here is a bran-NEW, exceptionally practical manual which will teach you many kinks and tricks, ways and means to take and sell pictures. Written entirely for the amateur or semi-professional camera hobbyist, it clearly demonstrates by pictures and directions the principles of picture taking that bring you photos which are marketable-and how and where to sell

COMPLETE, FASCINATING Easy To Understand

The Ingenious amateur who can learn how to apply some of the simple rules in this book can make chough money with his camera to pay for all his photographic activities, and by aside some welcome profit as well.

THE TWENTY FIVE SECTIONS

of the manual cover such subjects as Photography Ian't Difficulti Salable Pictures of Paople; Dollars From Architectural Photography; Pictures For Publication; Pictures For Ratography; Syndicating Photographs; Pictures For The Magazines; Landscape Dollars; Selling Photographs To Manufacturers; Developing and Printing For Others; Ministure Camers Possibilities; Lantern Slides and Their Relatives; Balvaging Old Photographs; Still-Life Photography; Photographic Novelities; Accidental Profits; Nature Photography; Movie Profits; Coloring, Retouching, etc.; Invisible Light Magic, What About Stereo Photography? Useful Accessuries You Can Make; Miscellaneous Information.

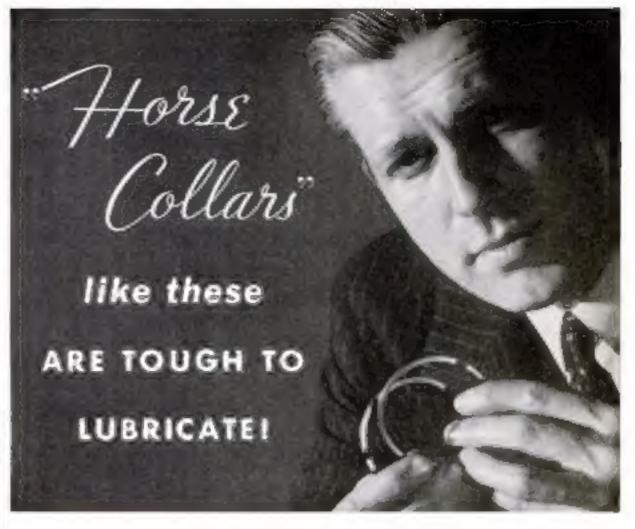
Send No Money Now-Just Coupon

We will mail C. O. D. You pay Postman. You risk nothing because POPULAR SCIENCE publishes this book, and will absolutely make good if you are dissetisfied.

Popular Science Monthly 353 Fearth Avenue, New York

Send the MAKING MONEY WITH YOUR CAMERA. I will pay Postman \$2.00 plus a few cents postage when the book arrives. You guarantee to return my money if I send the book back in ten days, (If you prefer to enclose cash, send \$2.00).

HAME	_	_
ADDRESS,		_
CITY	liv	72.00



TES, THESE are horse collars — the I modern kind-piston rings! They harness the might of 60 to 100 horses.

Piston rings are vital parts of your motor. Pennsylvania motor oils supply special lubricating qualities to keep these vital parts-and others, too-from "gumming up" or wearing away.

"New" oils, made by new processes, frequently claim to be "equal to Pennsylvania." But trying out new unseasoned oils is costly business. As one engineer puts it: "There's simply no use taking chances, as long as I can get Pennsylvania oil." He's right! For smooth, sure protection and unfailing performance, you want. ods that have thoroughly proved their worth. And that, for 40 years, is exactly

what Pennsylvania motor oils have done.

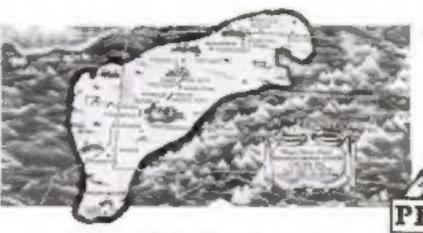
Look at the map! The area shown there is where Nature stored her richest, finest lubricant - Pennsylvania Grade crude oil. From this one special crude are refined all the motor oils sold under the insignia of the Pennsylvania Grade Crude Oil Association.

No refining method can take the place of the best row material-Pennsylvania Grade Crude. Pennsylvania motor oils are better oils from the ground up.

For trustworthy lubrication, insist on a Pennsylvania motor oil sold under the emblem shown below!

Pennsylvania Grade Crude Oil Association Gil City, Pennsylvania

Coppright 1935, Pennsylvania Grade Crists Of Asse.



What This Emblem Means!

This emblem is the budge of membership in the Pennsylvania Grade Crude Oil Association.

You are protected when you buy oils sold under this emblem, because it assures you that (a) they are made 100% from Pennsylvania Grade Crude, (b) they most or exceed the high minimum standards not by the Association to aware proper labrication of modern momes.

Safeguarding these assurances are: (1) the research laboratory of the Association at State College, Pa., (2) a national field force, and (3) each member's individual surery bood.

FINE OILS FROM THIS REGION...

ARE IDENTIFIED BY THIS EMBLEM

PENNSYLVANIA Mode from the highest greate cruste nil in the world

IOO%PURE

BETTER OILS FROM THE GROUND UP

PENNSYLVANIA MOTOR

POPULAR SCIENCE MONTHLY FOR JULY, 1935

MODELS	Pocket Safety Rezor 37	CRAFTWORK
10,000 Rivets in Toy Railway 26	New Ring Cuts String 37	Making Knot-Work Slippers . , 65
A Model of the Normandie 57	Robot Tells When Train Goes . 37	Modern Book Ends from Scraps . 80
Model Construction Kits 88	Odd Windmill Bost 37	Detechable Collar Holder 81
NEW DEVICES FOR	PHOTOGRAPHY	WOODWORKING
THE HOME		Finishing Our Racing Rusebout . 67
Double-Door Refrigerator , 46	X-Ray Movies 18	Antique Tip-Top Table 74
Loudspanker Telephone 46	Helps Edit Home Movies 33	Home Workshop Blueprints 76
New Monogram Transfers 46	Switch Saves Photo Lamps 70	
Vegetable Slicer and Shredder . 46	Lens Shade for Ten Cents 70	IDEAS FOR THE
Straightene Jar Lide 46	Double-Duty Enlarging Easel 70	HANDY MAN
Magazina Ruck in Chair Arm . 16	Handy Darkroom Thermemeter . 70	Ornaments for Bottle Stoppers , 60
Light for Game Table 47	DADIO	New Ideas in Fences 60
Individual Dish for Bones 47	RADIO	Sliding Dowel-Hole Jig 60
Handy Hose Coupling 47	New System Eliminates Statie . 16 Car 3rodies Redio Echoes 19	Chart Forecasts Local Weather , 61
Bottle Stopper Snaps On 47		Garden Pool from Old Tank 62
Automatic Doorway Lights 47	Rebind Scenes in British Rudio 22	
Non-Stick Constert 47	New Wired-Radio Set 26 Compact Radio-Phonograph , 28	Handy Carrier for Kayak . , , 62
NEW PROCESSES AND	Compact Madao-Francograph , , 20	Ministure Merry-Go-Round , , 62
INVENTIONS	UNUSUAL FACTS AND	Whittling Wooden Sea Contain , 63
Roller Skates in Shoes 16	IDEAS	Home Shop Planned for Moving , 64
Aero Cars Ride Cable 18	Fastest Steam Lacomotive 16	Simple Wardrobe Hanger , 64
Helps Shake Down Thermometer 19	Aluminum Telescope Microra . 17	How to Make Modern Shelver . 64
Hoels Are Reversible 19	King's Ring Helds Pass-Kny 18	Comfortable Forch Glider 66
Gless Boots New Medical Aid . 27	Cultivator from Motor-Cycle 19	Homeworkshop Guild News 68
Compact Saw Outfit 28	Concries Aid Herodity Tests 23	Old Bill Says
Scale Transparent Bags 28	New Coast Guard Rescue Bost . 26	Spacing Slots of Driver 73
Blectrie Organ Markered 29	Sails Aid Stummers 27	
Nozzle Ruises Propeller Power , 29	Neckties of Wood ,	Removing Weatherproof Insulation 75
Device Shoots Murbles 29	Trolleys Are Humpbacked 32	"Wire" Edges Buffed Away 75
Megaphone Electrified 34	Odd Fish Has Four Eyes 32	Knitting Bag Stands beride Chair 90
New "Comero" Aids Artist 34	Ancient Writing Muchine 32	A 12.000-Volt Transformer 82
Bieyele Lock in Handleber 34	Tree Surgery for Grapevine 33	Coloring Zine Black
Non-Spill Drug Spoon 34	Cuts Nerve to Care Discuse 33	Tape Protects Insulation 84
Nuil Has Two Heeds 34	Cattle Fodder Irom Wood Polp . 35	and the second second second second
Novel Ferry to Carry Autos 34	Masks Protect Boxers' Faces 36	Keeping Small Tools Handy 91
Robot Phones Police 34	Wasps Float Prey Home 36	Ammonia Cleans Ruling Pan 91
Folding Dressing Room 35	Roses Have Twelve-Foot Stems . 36	Chains Open Boat Channel 93
Piano Is an Orchestra 35	"Graveward" Teste Wood 36	Improved Archer's Arm Guard , 107
Phonograph-Needlu Dispenser . 36	Rays Aid Fossil Study 37 +	Dinner Gong from Souvenir 107

In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

Copyrighted inaxeral

OLD-FASHIONED

SIMPLICITY



TELEPHONE SERVICE in this country is modern. It leads the world. Yet there is an old-fashioned simplicity about the Bell System. This applies to capital structure and financial methods as well as to the nation-wide plan of decentralized operation under centralized control.

The American Telephone and Telegraph Company has only one class of stock and that stock is not watered.

It has 675,000 stockholders living in every corner of the land. Their average holding is twenty-eight shares. No individual or organization owns as much as one per cent of the stock. There are no secret reserves or hidden assets.

This structure is not of recent origin, but dates back many years to the early days of the telephone. It has lived on because it is right and in the best interest of the public. It has been fundamental in making the Bell System a distinctive American business.

Research for the Bell System is carried on by Bell Laboratories. Manufacturing, purchasing, distributing by Western Electric. Both help in giving the country good, economical telephone service.

BELL TELEPHONE SYSTEM



50 Edsy!

THE NEW, IMPROVED SIMONIZ KLEENER QUICKLY MAKES DULL CARS SPARKLE LIKE NEW AGAIN



SIMONIZ

Get a can of Simonis and Simonia Kleener . . . try this famous beauty treatment that all America is talking about. If your car is dull, the new, improved Simonia Kleener will bring back all the beauty the finish had when new - and quickly. Of course, it is Simonis that makes cars stay beautiful. Although easy to apply, it not only protects the finish, but makes it last longer and keeps it from fading. So, it doesn't matter whether your car is old or new, it should be Simonized, and the sooner the better.





Old paint can be taken off easily with new point removers available in paste or liquid form

Home Repairs MADE EASY

With These New Tools and Materials

WO new types of paint removers can be added to the list of timesavers for the home owner. One, a paste, is designed especially for outdoor work. The other, a liquid, will remove paint from metal as well as wood and is especially valuable for removing the old finish from the body of a car. The paste remover first is usade into a solution with water and then applied to the surface with a brush. After a few minutes, the old paint can be peeled off easily and quickly with an ordinary putty knife. The liquid remover also is applied with a brush, but a bose and a sponge replace the scraper to remove the loosened paint. Either warm or cold water literally washes off the old cooting, leaving the surface smooth.



BRACE ADAPTER CHUCK TAKES SMALL DRILLS

DESIGNED as an aid to the handy man whose supply of tools is small, an inexpensive adapter chuck recently introduced transforms the usual bit brace into a two-in-one unit. Having close-fitting, spring-operated jaws, it makes it an easy matter to use small, round drills in the ordinary hand brace designed for wood bits. Its three jaws will grip even the smallest drill tightly, while its square tapered shank fits into the chuck of a hand brace like an ordinary bit. Putting it in place or removing it is just a matter of a few seconds. A few twists of the wrist double the use-fulness of the brace.

NEW WATERPROOF PUTTY IS MADE OF RUBBER

BECAUSE it never hardens, is waterproof, and sticks to metal as well as wood, a rubber putty now on the market provides a good material for use in scaling glass in picture frames and any type of window. Containing rubber, the new putty also is flexible and will not shrink or track. It can be applied with an ordinary putty knife and takes paint readily without causing it to crawl or blister. Sold in friction-top cans, it can be stored easily without fear of spoiling.

EXTENSION HINGES MAKE WINDOW WASHING EASY

Born sides of a casement window can be washed easily from the inside if it is fitted with a pair of the extension hinges shown. Projecting from the sill several inches, they swing the window free of the frame and provide enough space on the hinge side to allow the arm to pass through. Easily applied, they require only a few screws and can be put in place on any easement window in a few minutes.



With those extension hinges, the task of washingensement windows is made much less difficult

NEW FIREPROOF PLASTIC

Among the materials available for summer furnace repairs is a new fireproof plastic. Capable of withstanding a temperature of 3,000 degrees F., the easily molded substance can be used either as a crack filler or as a fire-pot lining.

HANDY APPLICATOR FOR REFINISHING SCREENS

RESENTATIVE a blackboard craser, a new type of applicator simplifies the job of refinishing window screens. Dipped in the enamel and rubbed over the wire screening, it spreads the finish evenly and quickly, insuring a smooth surface and eliminating the thick spots, filled-in places, and spatters usually associated with amoteur screen-refinishing jobs. It is designed for use with a new special screen finish that dries quickly, prevents rust, and is self-smoothing.



Screens refinished with this handy enamel applicator have the smooth finish of professional work

What an Athletic Director of Indiana University did for his daughters





To The Equitable Life Assurance Servety of the U. S. 390 Secreth Avenue, New York, N. V.

Please small a capp of your booklet describing the Equitable Case Method of life insurance planning.

67PS

APPELSO

It was back in 1922, when Mary was eight and Catherine was five. Their father felt his responsibility strongly. He wanted to make sure that no matter what the future held, his daughters would have funds for a college education. He naturally turned to life insurance.

An Equitable agent helped him work out Educational Fund policies providing that, when the girls reached eighteen, the proceeds would be paid to them, over a fouryear period, in quarterly installments.

The father lived only fifteen months after the policies were issued.

Mary is now in her third year in the School of Journalism at a mid-west State University. Catherine will enter an art school in Chicago next fall.

Because of their father's thoughtfulness and foresight, both of these girls will be soundly equipped to face the world.

* * *

This life insurance program, prepared so carefully to meet the needs of an Athletic Director and his family, is but one of many thousands which Equitable agents, trained in the Case Method of life insurance planning, have put into effect for far-sighted people.

You too have obligations to yourself and your family. Let an Equitable agent suggest an insurance program especially adapted to your own conditions.

THE	EQUITABLE
	SAIR - ILLET

FAIR - JUST

LIFE ASSURANCE

SECURITY - PEACE OF MIND



SOCIETY
MUTUAL - COOPERATIVE

OF THE U.S.

NATION-WIDE SERVICE

Thomas I. Parkinson, President

Our Readers Just What Laws of Physics Do You Mean?

To Its young fellows out here, surfboarding is, in the large part, the biggest form of

amusement, I see, too, that it has been taken up at many California and Florida beach resorts. The history of surfboard riding is interesting, all right, but what is more so is the way in which the Hawaitans seem to dely all the laws of physics by riding huge waves, twenty feet high, that nearly give a melabine



heart failure. Surely, one of you myriads of readers can tell us the secret of high-speed surfboarding,-O.Y., Honolulu, T. H.

A Business That Is Always Active

For the world's champion partnership I nominate the firm of Plankton and Benthos. They are in business twenty-four hours in the day; in fact they never stop working. Without them, the land might soon be overrun with creatures from the sea, and human life could not exist. For plankton is the weak swimming life in the sea, and benthos, the life upon the sea's floor. One partner feeds upon the other, and together they maintain the balance of life. Something to wonder at !- C.F. P., Detroit, Mich.

Aquarium Beautifies Fireless Fireplace

I preserve I have a new idea for you. Here it is. We have an open fireplace in our living room. We grew tired of our gas logs, and removed them. In their place we put two layers of brick to match the mantel, just large enough to fill the opening. On top of them we put an oblong glass aquarium, twenty by twelve by sixteen inches, with fish and green plants and shells. Behind the brick platform we laid an electric cord and a red light, which, when turned on at night, gives the aquarium a sunset glow. Our living room has taken on a delightful aspect, and we get many compliments for our original idea, which we now gladby pass on to all interested readers of Popular Science Monthly, R.P.H., Lockland, Ohio.

Wigwams, At Least, Ass American

What America needs is some American architecture. Nearly every house in the United States is either NOW ARROW THERES.

Greek, Roman, or Gothic in design. Why not a house that is an expression of American ideals? I mean the ideals of courage, progress, honesty, frankness, and intrestitieness typical of the frontiersman and pioneer. Come on, some



of you, submit some suggestions for a real United States architecture. It's high time somebody did !-- McK., M., Cambridge, Mass.

Freakish Tricks Played By a Volcano

READING the article on the "Earthquake Machine" in the May issue of Popular Science Monthly, I was reminded of a strange story I heard recently. It concerns a volcanic eruption, rather than an earthquake, but, after all, the two are related. A geologist friend of mine, who has been prospecting for rare minerals on the volcanic islands of the Caribbean, told of seeing relies recovered from the ruins of Saint-Pierre in Martinique. Thiscity, se everybody knows, was destroyed by an eruption of Mont Pelce in 1902. It seems that the disaster took the form of a sheet of flame which came down the side of the mountain and seared everything in the town. In the rusns of the stores, excavators have found bottles of perfume with their necks sealed by the heat; when the bottles were broken, the scent was found unimpaired after more than thirty years under the ashes. In the banks, stacks of gold coins were found fused together in rods of solid gold .- J.B.B., New Orleans, La.

This Windmill Thought It Was an Autogico

Sour time ago while working on an experimental wind electric plant, I built a new type

of windmill. It was mounted on a turntable on top of a fiftyfoot barn, and instead of using blades for the propeller, I used two old auto wheels, which I fastened one at each end of a five-foot shaft. This shaft turned in a block with adjustable bearings, fastened to the turntable. Running full length,



between the wheels, I fastened sheets of tin, to form pockets, six of them. After I got this assembled, I connected the generator as a motor, and turned on the saice to see how it would run. Just as I got outside the barn to take a look, the whole contraption started up into the air, pulling turntable and generator right up the turntable shaft with it. Of course, at about two feet, things flew all apart. I got the idea that a contraption built up in sections so one section would revolve right and the next left would produce an awful pulling power. These sections could be built about the size of a common steel barrel, and driven at a high rate of speed. They would certainly haul something up into the air, and would save weight and space -CWP Fort

And No Fair Using Junioc's Blocks

Here's a problem to be done without using any pencil or paper. It is a test in what is known as power of visualization, and it is a tickler. After you have tried to figure it mentally-and lots of people get it right by sharp thinking-you can figure it out on paper, if you must. Here goes: a cube is built of small cubes, uniform in size. Each small cube is a rable tach. The large cube is three inches wide.

three inches high, and three inches long; in other words, each face of the big cube is nine square inches in area. Now then, a coat of paint is applied to the exterior of the large cube. How many of the small cubes will be painted on three sides, how many on two sides, how many on



one side, and how many on no side at all? Can you do it?—E.H., Des Moines, Iowa.

Maybe That's What They Call Truck Farming

I've seen a couple of letters on the Fred Frame vs. truck drivers argument. I don't care how Fred drives a car in races, but I want to say that truck drivers are good drivers I They have to be. Out here where I live. we are pinety-two miles from a railroad. All goods are trucked in; farm products are trucked out, excepting some of the livestock that goes out under its own power, It's all dirt roads, and up until two years ago sixty miles of it weren't even graded. It isn't sandy soil, either; it is real, old-fashioned numbo, if you know what that is. I've had balls of grad as big as wash tubs form on the wheels: I've even had to take the wheels off to clean them. I still my, a truck driver has to be good. - W.S.S., Broadus, Mont.

It Must Have Been An Emergency Light

Ove might a friend and I were running my electric train in the basement when it was derailed. The wreck smashed the burned-out light bulb in the headlight of the engine. We put the cars back on the track and turned on the current again. To our great surprise, Mr. Busted Bulb, which had not been removed. lit up and stayed lit for about three seconds. Perhaps some of your intelligent readers can tell us "how come." R.J.R., Sioux Falls, S. Dak.

You Have To Jump First, And Then Listen

LIKE everybody else, I meserally jump or give a start at any unexpected foud noise, such

as an automobile backfire. Now, Pve noticed a curious thing-that I jump first and hear the sound afterward, with just a split secand in between. This is just the opposite of what might be expected, it seems to me. The natural sequence of events would be for the nerves of the ear to carry the sound to



Convergent interest

the brain, where it would be heard, and for other nerves to carry an impulse from the

brain to the muscles. Perhaps jumping at a loud noise is a reflex, however in which this roundabout mental process is short-circuited. if so, what touches off the reflex? The powerful air waves striking the skin? Here is something a scientist might find interesting to investigate. I wonder how many readers have had a similar experience, and whether any of them can suggest an expranation -E.F.C., New York, N. Y.

Thus Idea is as Old as The Ben Hur Sweepstakes

Trees suggestion may seem goofy, but it has its points. At a horse race, you mus about

half the excitement because the horses are so far away when they are on the back stretch. Why not have a rotating track so the horses would be running in front of the stand all the time? Or have the stand revolve around the track to keep up with the horses just as an obervation train fol-



ows along the shore during a crew race? Why should the spectators only be in on the start and the finish?-H H., Baramore, Md.

Gold-Mining Methods for Finding That Ring

It smouth be easy for GCK., of Whippany, N J., to find his gold ring, if he really knows just about where he lost it. He should first burn and cut off all grass and weedwhere the ring could have fallen or rolled Then take a screen just course enough that the ring can't go through it, and mount it horizontally in such a way that it can be shaken. Shave a layer off the ground, going as deep as any scratching or digging that has been done since the ring was Jost. All this dirt should be put through the screen very care fully and the oversize sorted. It he does the work thoroughly and systematically, he can't help finding the ring if it in there, The job should not take long, unless the area is very large. I have followed gold mining all my life, we wash our dirt to get the gold from it, but G.C.K. can solve his problem by mere ly acreening the dirt. Here's hoping be finds his ring without having to shovel up the whole county.--H W.H., Rocklin, Calif.

Self-Making Bed Is Boon to Bachelors

Some time ago a reader mentioned a "sellmaking bed" as an invention that ought to be worked out. This

old bachelot agrees. How would this do? Take a bed with no zailing at the foot like a studio coach and fit a L shaped frame of light lumber around. it Pivot the frame hear the head of the bed, on each sale Have clips slong the squared bottom of the "L", and eyelets at



one of the narrow ends of all the bedelothes. Now chip on sheets and blankets as desired. Up with the frame, and all the bericlothes hang vertically, arranging themselves and smoothing themselves out. Down with the frame and the bed is made, the overlapping parts of the bed covers being caught and held by the frame. Remaking the bed means simply rusing the frame and letting it down again. Of course there should be enough clearance so as not to tear the bedelothes. Maybe there a a catch in this somewhere, but I don't see it.-K.R., Long Jaland City, N. Y.

Stratosphere Flights Went Over This Reader's Head

AMOTHER goant balloon will invade the stratosphere this summer starting from the natural bowl in the Black Hills. In the metalball goodela, daring men will risk their lives for science. Why? What good can result? A few weeks ago, I would have been pretty positive about answering, "none at all." But I'm less cocksure now about a good many things And it's ail due to an article that appeared in your April usue. For years, I have believed that auto racing was nothing more than highspeed murder and suicide, without a redeeming feature. Your article opened my eyes, I had no idea that most of the improvements that make modern cars safer and better could be traced directly to the race tracks. Herearer I am going to be more careful about condemning daring undertakings as of little value. -RE, Nashville, Tenn

But the One That Got Away Was Much Larger!

Figure naturalists of the hothouse variety seem to think that six-inch trout are about the biggest fish that swim in the rivers of the United States. Well, let me tell you that the leggest, proudest, strongest denizes of the rivers of this country is being overlooked I suppose it's because he's too big to be believed in. He's the Columbia River sturgeon. that sometimes weight almost a ton.-- R.E. R. Scallle, Wash

Maybe he was Trying to Imitate a Blowfish

I would like to give some information to gotelfish keepers whose fish are having trouble

Maying at the bullom of the squarters. 1 had a fish that continually got indigration and accumulated gas within himself that brought him to the surface I found that a linge of mercuro chrome in some water acted as a slight lax ative and cured him within a rought of hours. This is also



HE AND WILEY POST SURE HAYE

OUR TROUBLES

good for fish as a stimulant.- J D L., Riverton, N. J.

Has any reader some toeas on how to make a mechanical perator for a tropical fish tank? I would very much appreciate a few suggestions.—F M., Brooklyn, N. Y.

They Might Put the Rug In a Zoo

I see that a rue made out of the skins of eighty duckhills has been placed on exhibition in New York. The duckbill, or platypus. is one of the strangest, rarest, and most det icate of zoological specimens. It is not adapted to travel or to captivity in a 200. Why anyone should want to make a run out of duckbill skins is more than I can understand. A good live specimen is worth about \$1,400 to any zoo. Why? Because the platypus is an egglaying mammal, and a possible link, in evolution, between the mammals and the birth. But a rug? I can't see it .-- R.N.R., Sydney, N. S. W., Australia.

Keeps Both Eyes Open Now

I usen to think that making myself squinteyed, wall-eyed, cross-eyed, or hat-eyed by staring through a metal and glass tube at teny things that you can't eat, drunk, talk to, sit down on, or make use of in any way, was the sillicit possible way to spend lessure time Now I know I was wrong, I don't own a hin-

ocular microscope, but I am used to keeping both eyes open now, and find my bobby of microscopy not only pleasant but downinght exciting.—P.H., St. Paul. Minu.

Reverse Umbrellas To Catch Rain on the Rebound

Henc's an idea for some of your inventive readers. We have umbrelias, raincoats and

sou westers to protect us from water falling trong above. But we baven't anything to protect us from water sotashing up from below. What I would like to see is some kind of midget umbrellas or flat oval guards that could be snapped on around the ankles to keep water from splashing



up as you walk along on a rainy day. Let's get to work on this .- E E. Chicago, Ill

What Do You Predict for 1960 and Bryond?

Ir 16 July, 1950. The theater is operating under a Government subsidy Technicians, electricians, stagehands, muncinos, all get paid regularly by check from Washington, regardless of the size of the audience There is no audience, in the old sense of the word. Everybody sits at home with his friends in the bittle room now known as the Radioteletheatron Instead of a television screen, this new machine presents a crescent-shaped stage on which figures, made of light, and appearing to have three dimensions, perform in full color, with sound .- L.P., Los Angeles, Culti.

The Rhinoceros As A Cause of Long Life

Ar subject Chinese gratteman of my acquaintance was asked recently how he managed to grow to be so old "so youthfully " His answer brought to light a strange fact about Chinese medicine. I am turning the fact over to the readers of Portlan Science MONTHLY for their entertainment, "I am so old, and at the same time, so youthful," said the aged Chinese gentieman, "because of this drug." He passed a little lacquer box from his sleeve and showed us a grey powder. "This is powdered rhinoceros horn, of which I take but the timest proch a day, he said, smiling I visited a Chinese pharmacy subsequently and was very oblightely shown a quantity of the stuff, which I leathed, much to my surprise, costs \$100 for about one cubic each. It was known in Europe, centuries ago, as a cure for fever -- J.E.E., Shanghal, China.

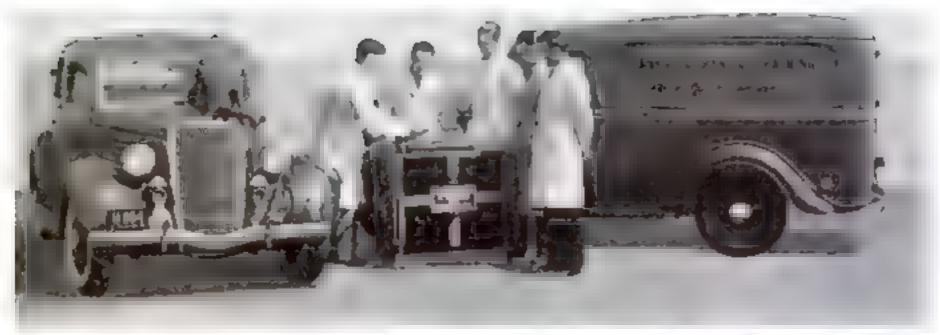
Chemists, Attention! What Turns Glass Purple?

Here in Arizona, and also in some parts of Texas and New Mexico, and in the dry, hot.

desert parts of Cafeforms, certain kinds of clear glass and some old milk glass turn a perfect shade of amethirst if exposed long enough to the rays of the sun I have sev eral bottles colored a beautiful purple Some of you readers can no doubt explain the chemical reaction that occurs. I find that by



putting a piece of the deepest color into a fire, it will turn back to its original transporence Why is that? Also can you say whether the amethyst color will last if the glass or grassware is kept out of the sun?- Mrs.A.S., San Simon, Anz



Mechanics receiving expert instruction in the use of the Laboratory Test Set

Laboratory Test Set

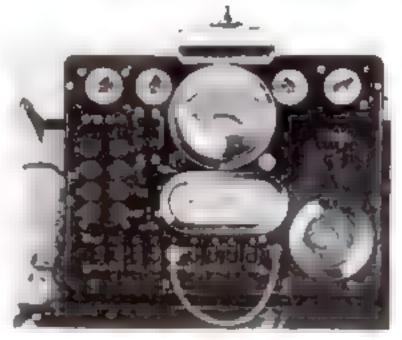
HELPS AUTO MECHANICS

Scientific service-station equipment is eliminating trial and error methods in the work of automobile mechanics. One of the most interesting developments in this field is the Ford Laboratory Test Set. For many months it has demonstrated its uncanny accuracy in the shops of Ford dealers and has proved conclusively that it saves time and money for Ford car and truck owners.

Combining a number of sensitive laboratory instruments and gages in one complete unit, this portable Ford Laboratory Test Set can be rolled to the side of the car. It permits the operator to make tests quickly and accurately for every condition that can affect engine performance and the entire electrical system. Further, it enables him to adjust such units as the carburetor and distributor with a high degree of precision. Ignition coils and condensers can be definitely checked It determines the condition of valves, piston rings and spark plugs. It tests the car radio and tubes in addition to the lighting circuit, generator, starter, fuel pump and other units.

If the type of precision units co-ordinated in this apparatus were to be purchased individually the cost would be so high that only the larger service stations could afford to use them. The Ford Motor Company has made it possible to build and sell the Laboratory Test Set at a price which every Ford dealer can afford.

This is in keeping with the Ford idea of enabling dealers to provide the most efficient service for owners of Ford cars and trucks.



These sustruments and gages tell the complete story.



Master Meter Indicates condition of radio tubes.



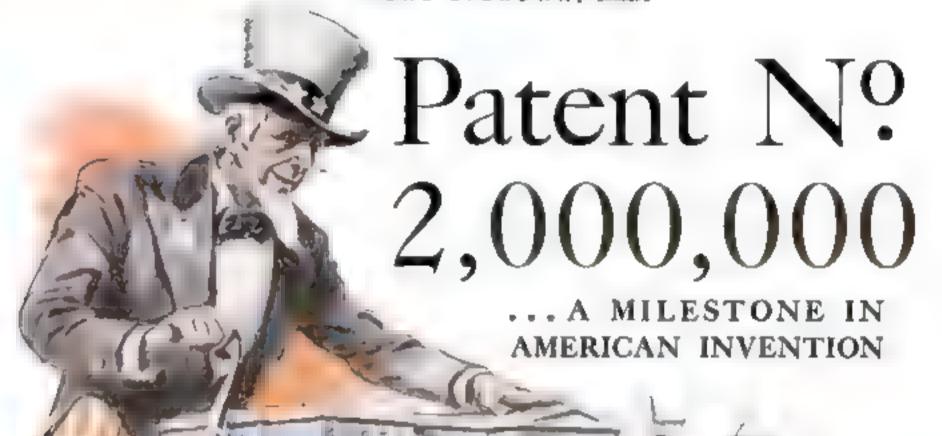
FORD MOTOR COMPANY . DEARBORN . MICHIGAN

JULY 1935

POPULAR SCIENCE

VOL. 127 No. 1

RAYMOND J. BROWN, Editor



By AUBREY D. MCFADYEN

Examiner, U. S. Potent Office

U.S. Patent No. 3.000,000 to Joseph V. Ledwinka, of Philadelphia, Pa., the American patent system passed an important milestone in its fruitful history. The present series was inaugurated in 1836; in less than a century, American inventive genus has piled up this amazing number of contributions to the comfort, convenience, and safety of human life.

The historic Ledwinka patent covers improvements in the application of pneumatic tires to railroad trains. It is the 248th patent to be granted to this outstanding inventor, who, by his work during the past thirty-six years, has greatly influenced the development of the modern automobic and streamlined train, Ledwinka received his first patent, No. 638.643, in 1899, on "a means of propulsion of vehicles by electricity." Perhaps his most important single contribution to the development of the automobile was the all-steel

body. He also invented a process for drying lacquered bodies by electric induction employed today in many leading automobile plants. His latest achievement will contribute materially to the comfort and safety of railway travel in the future.

But, aside from its intrinsic merit, this two millionth patent is interesting in that it marks an important point along the bistoric road of inventive progress. The Ledwinks potent stands at the end of the second million of patents, which includes such inventions as talking pictures, air cooditioning, and the radio-in short, some of the most important factors in modern life. It likewise stands at the beginning of the third million of patents. Perhaps it may presage what the inventive genius of man has in store for us. Probably some of the great inventions of the future are embraced in the 108,000 applications now pending before the Patent Office.

One cannot contemplate two million patents—thirteen for each day since the dis-

Averaging sixty patents a day over a period of ninety-nine years, Uncle Sam's patent system has proved its value as a stimulus to new discoveries

The public accentific library of the U.S. Patent Office a excition of which is shown above, contains records of more than three million foreign patents, and copies of scientific publications.

covery of America and more than double the number granted by any other nation without reflecting upon the nature and growth of the American patent system. Most likely, the reader wonders why in the world two million patents should have been granted and who made this astounding number of inventions

The principles of our patent system are both simple and brief. These principles have not been materially altered in a century. In general, any person who has invented any new and useful art, machine, manufacture or composition of maller, or any improvement thereof, may obtain a patent on it. An application must be filed with the Commissioner of Patents, accompanied by the necessary papers fully disclosing the invention and the usual fee to cover the cost of examination. The Patent Office thereupon searches through all the prior patents and publications, both domestic and foreign, bearing on the invention, to determine if the application presents something patentable at must be new, useful, and involve invention. The word "invention" requires that the application present something not obvious and not within the skill of the ordinary mechanic. If the Patent Office investigation is favorable, the applicant is granted a patent cuvering his contribution

THE patent gives the inventor the exclusive right for seventeen years to make, use, and sell the invention. The patent corners a legal presumption of validity in marked contrast with most foreign countries, the United States patent is not taxable nor does it involve any obligation upon the inventor to employ the invention. The patentee can do with his invention as he pleases for seventeen years, at the end of which period it incres to the public

It is interesting to observe how the United States has progressed under this distinctly American patent system. At the time it was adopted we had no telegraph no rapid printing press, no high-speed steam engine; no harvester, hinder, and

In the photostat division. photograph c copies can be made of the original docaments on file

reaper, no sewing machine no talking machine; no dynamot, electric motors,

of electric cars; no telephones, no electric lights, no electric refragerators, no electric washing machines, no oil burners, no automobiles, and, of course no flying machines and radios. One after another these inventions have been fostered by our American patent system so that new industries have been created, and new avenues of employment provided

Take, for example, the Bell telephone. From that one invention has sprung one of the biggest industries in the world, providing wages for hundreds of thousands of persons, in every city, town, and village of the country. The moving picture has developed into a major industry. besides furnishing entertainment to the nation. The automobile aside from its practical benefits, in manufacture, service, repair and road construction, furnishes employment to far more men than comprised our World War

The Westinghouse air brake presents a different aspect. While the president of the Peonsylvania Railroad is said to have laughed when it was suggested that a train of cars could be stopped with air he lived to see the day when satety laws forbade operat-

saved more fives than all of Napoleon's armes had destroyed.

The linotype machine, the cash register, the talking machine, the radio, the airplane, and such early inventions as the sewing machine, agricultural machinery and shoe machinery have each provided this country with an industry employing thousands of workers, to say nothing of the resultant convenience and cheapening of necessaties. Inventions in the printing it, for example, have put the daily paper in every home for a patience. No other country in the world has shown such prog-

ing a passenger train not equipped with such air brakes. Westinghouse made the proud boast that this invention, his first,

In considering the large number of epochmaking inventions that have been made



A section of the file room, where printed copies of all patcuts are available for sale to the public at ten cents each, The yearly demand for such copies amounts to 7,000,000

by Americans, we must not lose sight of the fact that many of these were the work of naturalized citizens of foreign birth. Alexander Graham Bell, creator of the telephone, and Nicola Tesia, who gave us the alternating-current motor, belong to this class. The atmosphere of encouragement created by our potent system, as well as the rapid expansion of American industry, stimulated such men to inventions which have made them famous throughout the world.

John Ericsson, from Sweden, designed the "Monitor," giving to the world the revolving turnet now used in every battleship. Emile Berliner, who came to this country from Germany, invented, among other things, the carbon microphone which u a vital part of the telephone. Charles J. Vandepoele, a native of the Netherlands, devised the under-running trolley and other inventions; Michael I, Pupm, a poor immigrant, invented the loading coil which first made telephoning across the continent possible; Charles P. Steinmetz, known all over the world as the electrical wizard, came to this country in the sleerage, so poor that he had to borrow money from a fellow passenger to satisfy immigration requirements.

*HE facilities and personnel of the Patent Office have grown with the progress of invention. On January 31, 1791, the first patent granted by the United States Government was delivered to Francis Badey, a Philadelphia printer, for "a method not before known for forming punches by which to impress on matrices or printing type various impressions difficult to comterfeit." This bistoric document was signed by George Washington and courterngued by Thomas Jefferson, then Secretary of State, who was designated by the original patent act to pass uppucations for patents. Little did these c figure and dream of the marve our inventions and the amaxing number of patents that were to for ow

By the year 1856 our Government has granted 9,957 patents, despite adverse patent laws and unfavorable economic conditions. The lack of facilities for passive upon the merits of patent applications on posed a further handicap upon inventors

In July, 1836, Congress first recognized that the magnitude of the task of examining the novelty of inventions and assuing the patents merited the creation of a separate branch of the Government service for that purpose. At the same time the law regarding the assuance of patents was absentized. The practice of assubering patents and recording them purnentally was also commenced at this time

Thus, from being a stepchild in the Department of State, the Patent Office broke away in 1836 and became a separate unit, with a force consisting of a Commissioner, one examiner, and two clerks. How it has grown! The personnel of the Patent Oftice today consists of a commissioner three assistant commissioners, an examining vorps of 633 persons and a clerical force of about 600. There are also at least 200 employees in the Government Printing Office engaged in printing and reprinting the patents. The examining corps is now divided into sexty-five divisions, each specializing upon some particular art or field. In the last ten years this force has handled 761,000 applications, resulting in the usuance of approximately 900 patents each week. The assignment division records approximately 50,000 patent deeds each year

All this belies the oft-repeated opinion that inventors have already devised about everything possible. It is said that in the early seventies an examiner in the Patent Office resigned his position and entered other employment because he was of the opinion that about every invention con-

crivable by the human mind had been made and he wanted to get into an occupation which offered permanent employment. At that time the phonograph and moving picture, to say nothing of the so-tomobile and radio, and many other inventions, were unknown. The examiners in the Patent Office today have no fear that they will rim out of work, for explications for patents are being made at the rate of 60.000 yearly

THE Patent Office occupies the north wing of the new Department of Commerce Building. It is by far the hest-equipped office of its kind in the world.

The dominating feature of the Patent Office is its scientific library and search room. The library contains copies of patents of all foreign countries—about 3.250,-000 patents in all-besides copies of all publications pertinent to science and invention. The search room is the only place in the United States where copies of alour patents may be found segregated into groups according to subject marter, or classes," such as apparel, beds, glass, and music. Both the library and tearch room are available to the public. Duplicate copies of all records are provided in the examining divisions for the private use of the examining corps.

Now, suppose you desired to see what had been patented in beds, for example. It would take two or three weeks to review carefully all the patents relating to beds; so to make it unnecessary to look through all these patents, they have been

subdivided into 364 groups, such as berths, sofas, cots, and hammocks. One can find, therefore, the particular type of bed he has in mind without reviewing the entire field. The art of music likewise is divided into 521 subclasses.

As one browses through these groups of patents it becomes evident that every invention we see in daily use is the result of a process of evolution. Any invention you could name represents the summation of improvements thought out by many inventors. Each succeeding patent represents an addition to preceding developments. Edison probably had this in mind when he once stated that his work was largely in perfecting the ideas of other inventors, Frequently, in this process of evolution, the final form an invention assumes is so far removed. from its original arrangement that it is difficult to associate the

In tracing the development of a device through the patents from germ to finished structure, the ancestors of modern apparatus often present curious, sithough logical, steps. One of the earlier progenitors of the typewriter actually wrote the words out in script instead of printing the lettern. Likewise, the transition from Old Dobban to the motor car ractuded a sort of twilight period during which the shades of Dobbin were yet visible. A Frenchman thought to bridge the gap by (Continued on page 192)



"Si apro sea long

way P Coc.

F4 4 6 66

U B Patent No.

seph V Ledwinka

at the left) in

Weshington, D. C.

New Studies of BONES

Accurate Measurements and X-Ray Pictures Reveal the Development That Molds Our Minds and Bodies

By JOHN E. LODGE

bones and one of the things be takes most pride in is the rurious anthropoid catacombs occupying a whole corner of the Western Reserve medical building

Here, you find row on row of neatly arranged ape shulls. In addition, there is a vast array of miscellaneous bones and a supplementary section housing 2 500 human skeletons, filed away in labeled boxes. In the present researches, this huge reference collection has proved of incestimable value.

Four thousand Cleveland children also have aided in the experiments. They have been measured and X-rayed over and over again, the X-ray phase of the work often beginning before birth. The result is a mass of data and photographs which reveal, like a vast scientific movie strip how the human body unfolds.

One of the most interesting phases of the work has been the discoveries made in connection with the human face. For instance, the experiments have revened that during the first five years, a child's face grows most rapicly in a horizontal, or broadening, direction; after that, in a vertical, or lengthening, direction

Facial bones, the experiments show, are extraordinarily

senative to disturbances in growth. If anything interferes with normal bone development in childhood, the appearance of the face is altered for life. Records at the Cleveland laboratory show that faces of undernourished children develop at a rate below normal. A change of diet will restore the normal growth, but the damage is done. In many cases, such



RITTEN on the bones of your body, Ohio scientists have discovered, is an animaing record of your past

Thousands of experiments at the Brush Foundation, Cleve-land, Ohio, have enabled research workers to decipher marks left by Nature upon the human akeleton. Sught scars in the tissue and the size, shape and condition of the bones reveal susprising things. With X-rays, precision calipera, and original apparatus, the scientists read the story of improper diet filness, operations, and even serious emotional upsets in a person's past.

In the course of their studies they have uncovered curious and important but of informa-

tion. They have discovered why some people remain baby-faced after adolescence. They have found that wrong diet may produce a pug nose. And, they have learned to read from our bones what we are when we

were six or ten or twelve years old

About six years ago, the research work began at Cleveland when Charles Francis Brush, inventor of the arc light, donated \$500,000 to establish the Brush Foundation at Western Reserve University. Its aim is to carry on studies leading to the betterment of the human race. The chatrman of the foundation is Dr. T. Wingate Todd anatomist and anthropologist, who since the beginning has been in charge of the bone-research studies.

For him the work is a hobby as well as a vocation. He has spent most of his life in the study of skulls and





X-HAY PHOTOGRAPHS SHOW HOW A BOY'S HAND DEVELOPS. Note the gradual filting is of the wrist bones in this series of pictures of the hands of boys aged are mouths, four years, and thirtney years, teapert.vely

Show How We Grow.

haded facial development accounts for grown-ups who are baby-faced.

Again, pug pases sometimes can be traced to improper diet in chadhood. Successive X-ray negatives at the Foundation give a clear picture of the way a nose grows on a human face. During the first six months of a boby s life, the nose grows most rapidly in the upper third, or smelling region. Then, the middle part forges ahead during early childhood. And, finally the lower part unfolds to its proper extent during the period reaching to adolescence, If anything arrests normal development before adolescence, the result may be a pug or snub nose

ANOTHER interesting fact discovered during the studies is this: It takes longer to make a boy's face than a girl's. The upper part of the head, above the nose, grows with about the same rapidity in both boys and girls. But, when adolescence is reached, the face of a girl stops growing while that of a boy continues for several years, the lower lip lengthening and the jaw becoming more musculine

In making these head studies, Dr Todd and his associates use a curious apparatus with sliding rulers, rubber-tipped arms and a battery of thumbscrews. This complicated framework of poinshed metal holds the subject a head always in the same position when the X-ray pictures are taken. Two tubes, one at the back and one at the side, give off the rays that record a rear and a profile view of the skult bones.

Another, even stranger looking apparatus aids in studying the many skulls in the large Western Reserve collection

Кножи аз а стациоstat, it suggests, at first glance, a huge metal tuning fork turned prongs-down on a beavy metal base. Attached to it are arms and rulers. moved by cogs and (bumbscrews By the use of the craniostat, the investigators can determine the exact measurements of any skull placed inside

Bones grow just as a tree branch grows. Minerals, chiefly calcium, circulate through the bones. Blood vessels penetrate them When illness or injury interferes with these normal processes, the bone growth is interrupted and frequently a scar is formed

Tracing such scars
to their causes has
been an absorbing
part of the work of
the accentists of the Brush Foundation

In one case, an anesthetic administered to kill pain during a minor operation caused a scar on the bine of a sickly chikl's leg. In another instance, X-ray pictures of a 3½-year-old girl revealed a dramatic and tragic story imprinted on



Dr. T. Wengate Todd using a transactat, an instrument developed at Western Reserve University for determining dimensions of skulla

hone, showing how even experiences hat are purely emotional in character can leave an indesible impression on the future growth and development of the body

At the age of two, the pictures showed, she had suffered some filness or injury yet, inquiry revealed that none of the

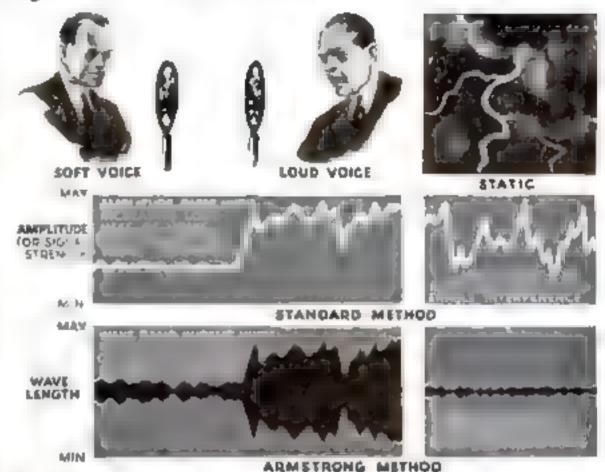
usual ills of childhood had interfered with her health at that time. Furbut investigation solves the invitory When the fit



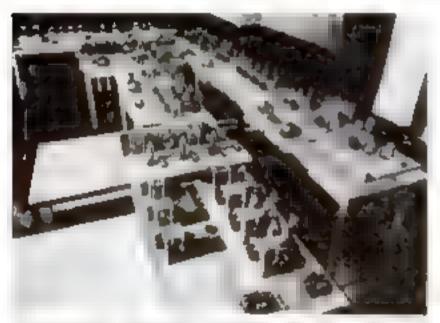
New Radio System Eliminates Static

STATIC-FREE system of radio transmission that turns accepted principles topsy-turvy has just been announced by Major Edwin H. Armstrong, one of America s leading radio engineers. Ready for immediate service in point-to-point communication, its use may eventually be extended to general broadcasting, where it would render conventional radio sets virtually obsolete, Advantages foreseen, however are that it would wipe out staric, tube noises, and fading; would make ultrashort-wave broadcasting practical; would pave the way for televis on stations linking all parts of the country, and would permit the transmission of musical programs of a quality unattainable in present-day broadcasting.

The Arms, rong system employs a basically new method of imprinting the pattern of voices or music upon radio waves-in technical language mochating" them Heretofore variations in loughest as a speaker should or whispers have been translated into radio waves of corresponding amplitude or strength, which are reconverted by home receivers into the loud and soft sounds. In contrast, the new system using waves of unvarying strength, translates loudness gradations into fluctuations in the width of a whole band of wave lengths on which the



The drawing explains the principle of the revolutionary new system which may but it states



Apparatus with which Major Armstrong conducted sected lesis of his new system grop the Empire State Building to New York City

transmitting station operates. Thus, while present-day broadcasters strive to maintain a fixed wave length, the new "frequency modulation" system does just the opposite. The 150,000cycle range required, unpractical at ordinary broadcast wave lengths, becomes feasible on ultra-short waves, and a new type of receiver makes the new agnals

Squawks and growls of static, caused by natural radio waves resembang ordinary broadcast

waves, are banished in the new system; hat use cannot imitate the peculiar wave pattern used. Unwelcome noises originating within the electrical circuit of the set itself, particularly troublesome in shortwave radio, are also suppressed.

Because of its attractions, the "frequency modulation" system was proposed more than twenty years ago. Experimenters tried vainly to make it a workable method until, last year, Major Armstrong obtained such promising results that a short-wave transmitter atop the Empire State Building was placed at his disposal. Tests went on secretly for months, unnoticed except by amateurs. A receiver at Haddonfield, near Camden, N. J., picked up the two-kilowatt transmitter clearly at times when fifty known t New York statrons were drowned out by static

ROLLER SKATES BUILT INTO SOLES OF SHOES

STARR BIN TO ELEPT KATPE 1 (t) (e) 31 (N) different and principles of the PER SERVE AND PROPERTY et resemble den kenne to the contract of the sale of the soie. When the skater tires of the he seek comments as to be

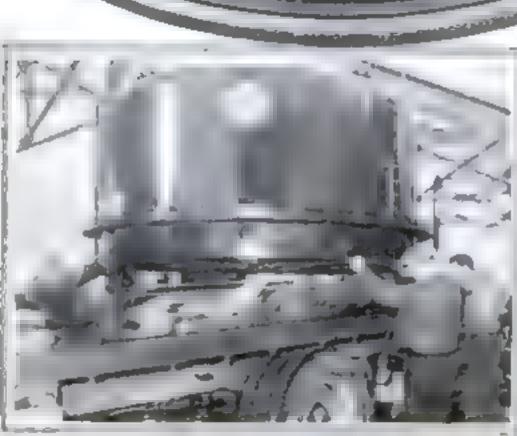


garao u mite which has ea period to set new apeau relative in transportation by rais

STEAM LOCOMOTIVE WILL GO 120 MILES PER HOUR

CALLED the fastest in the world, a steam locomotive just com-pleted at Schenectady N Y is declared to be capable of a speed of more than 120 mues an hour The stream; ned giant will shortly go late service on the Ch.cago. Mawaukee St. Paul & Pacific Railroad where it will maintain a 61/2-hour schedule between Chicago and the twin cities. Burning or it develops a relatively high steam pressure of 300 pounds to turn the seven-foot drivers. Roller bearings reduce friction, permitting quick and smooth acceleration, and no orling or greating will be required along the engine's run, Its brilliantly colored shell, painted yellow, red, and gray, gives the locomotive a striking appearance







A ROY WAY A COMMENT OF THE PARTY OF THE PART

This switch sends electricity into a vaccount chamber to vaporize aluminum and enermitter

twice a year since its silver became tar-

twice a year since its silver became ta fushed by contact with the air



LIGHTS WARN RACERS OF TROUBLE ON THE TRACK

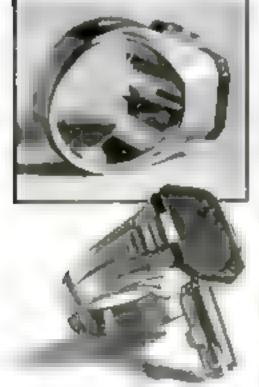
TRAFFIC lights for auto racers are an innovation at the Indianapolis Motor Speedway, where sets of yellow and green lights have been installed at intervals along the course. The green lights burn as long as the track is clear. In case of trouble, the lights change to yellow and the racers slow down until the aignals turn green again The photograph shows a set of the lamps on a footbridge across the attaightaway

X-RAY MOVIES AID IN WAR ON DISEASE

X-kay movies, first demonstrated by German proneers several years ago and now developed to a point well past the experimental stage, are belong physicians to fight disease at the Victoria War Memorial Hospital in England. The new technique as used in practical medical work, permits the film ing of the bones and internal organs in action. One of its most important applications aids patients with

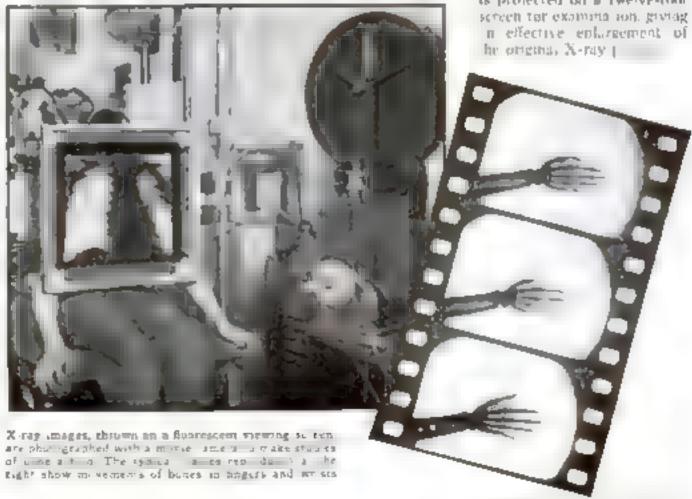
joint diseases, for example (t is now possible to take motion pictures showing the action of the bones as a patient flexes his wrist, and, by comparing films made over a period of time, to observe what progress has been made toward recovery. A movie camera photographs the X-ray images appearing on a standard fluorescent viewing

> screen, and the developed film is protected on a twelve-foot he original X-ray [



KING'S RING HOLDS HIDDEN PASS-KEY

RINGS worn by royalty have played a romantic part in history, but a modern monarch King George V of England, will soon make use of one with a thoroughly practical purpose. The unusual accessory contains a master key that opens the doors of a suburban house just completed for the British sovereign, For use, the ring is slipped from the finger and the key extended, as shown iznmediately above; at other times the key lies folded within the ring.

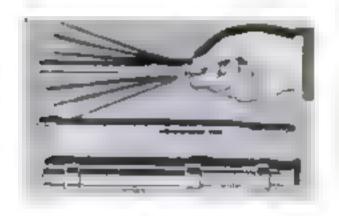


FOLDING CAMP SHACK CARRIED ON AUTO



SETTING a new mark in compactness, a folding shack for tourists and campers occupies little more space, when closed than an ordinary automobile trunk, and is

carried as easily on the back of a car. When unfolded at an overnight stop, it opens to ten times its former size, as shown in the photographs. Within the roomy quarters, two cots are arranged as upper and lower berths. Other fittings include a table, a lamp, two windows, and a step for convenience in entering



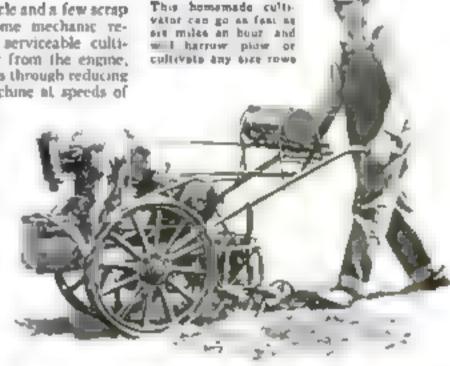
CASE HELPS TO SHAKE CLINICAL THERMOMETER

A "MECHANICAL WRIST" built into a new case for a fever thermometer saves effort in shaking down the mercury, and lessens the chance of breaking the instrument When the spring handle is given an easy to-and fro mation, the thermometer rocks back and forth, tapping against a metal seat. A few swings are sufficient to bring the mercury column below "normal."

From an old motor cycle and a few scrap. parts, an ingentous bome mechanic recently constructed the serviceable cultivator illustrated. Power from the engine, transmitted to the wheels through reducing gearing, peopels the machine at speeds of

MOTOR-CYCLE ENGINE RUNS CULTIVATOR

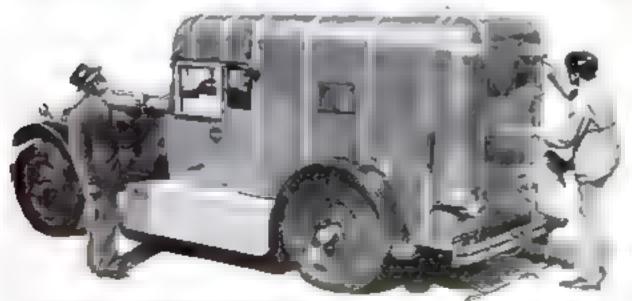
from two to six miles an hour, An ignition switch and a clutch lever are conveniently placed on the handles. which are fashioned from one-inch pipe. A fan cools the motor to prevent overheating The owner reports that his homemade machine will barrow plow, and cultivate rows of any size. The photograph at the right shows the ingenious machine in operation.



SHEATHED CAR STUDIES RADIO ECHOES

Resembling the armored cars that transport valuables through city streets, a traveling radio laboratory has just been placed in service by Harvard University experimenters. The copper-sheathed vehicle is

equipped with especially designed receivers and an ultra-high-frequency transmitter and will be used in studying radio echoes that seem to "bounce" from a reflecting layer situated many torles above the earth.

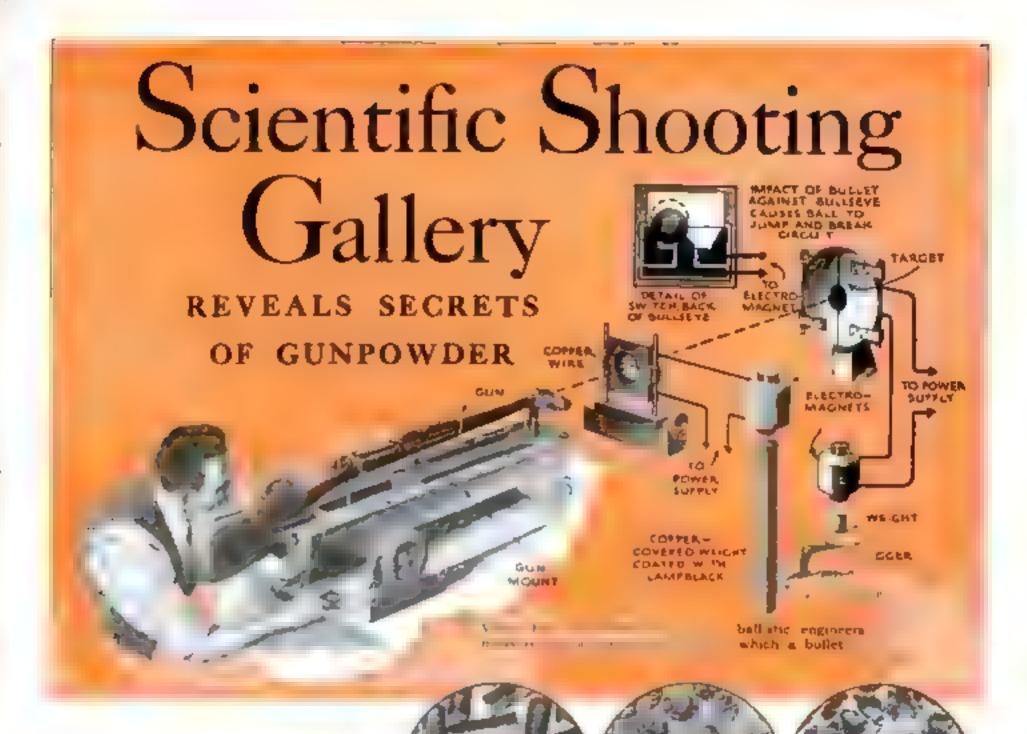


In this copper-sheathed traveling inhoratory, scientists will investigate mysterious radio echoes



HEELS ARE REVERSIBLE

REVERSIBLE subber heels for shoes are a recent German invention. When the wearer of a pair of shoes fitted with these beels finds them run down, he has only to slide them from their sockets as shown above, turn them over, and replace them, thus obtaining a new wearing surface. After both sides are worn down, the heels may be discarded and others put on.



LD you know that the position in which a cartridge lies just before being inserted rato a rifle may influence the course of the bu let? Or that a bullet will move faster, when it leaves the gun, If it is fired up into the air instead of downward? That huge quan rues of smokeless powder have been stored beneath the cold waters of mountain lakes? That grains of smokeless powder for some guns are as large as your thumb? That smokeless-powder grains for small arms are brack because of a graphite coating which prevents static electricity from igniting them?

These are but a few of the strange facts that you could learn if you were to visit a modern powder-research laboratory. But perhaps the most amazing of all would he the discovery that gunpowder is a sort of contradiction of itself. It is so absorute y dependable that a misfire of a cartridge caused by failure of the powder is extremely rare, yet powder has resisted the efforts of science to put it into a harness of figures and formulas. Even now the most reliable method of determining the behavior of a given quantity of powder is that of trial and ecror, although modern scientific methods of measurement are bringing about a clearer understanding of its qualities. This is one reason why a powder-research laboratory is on interesting place to anyone who is fond of shooting

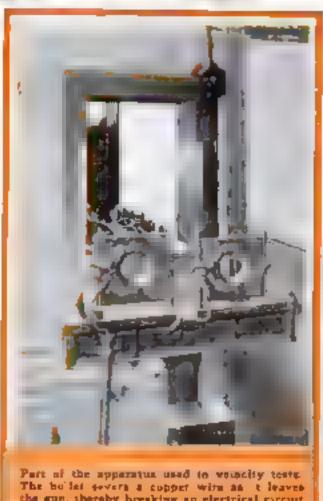
Across the river from Wilmington, Del., is such a center of interest. It is the Burnside Laboratory of the smokeless powder department, E. L du Pont de Ne-

AS THE MICROSCOPE SEES IT These photomicrographs show from alt to right, rifle-powder grains, pistol powder, and powder for chatgus shells

mours & Co., the place where modern gunpowder has been persuaded to give up many of its secrets. It is there that ballistic engineers and chemists have made some interesting observations on the behavior of powder, ammunition,

For instance, it was observed that different ballistic results were obtained when different operators fired a rifle mounted in an arm-testing device called a machine rest. Investigation revealed that there was a difference in the way the cartridges were handled just before shooting. Further study brought to light several facts which may be of interest to the amateur marksman, sportsman, and anyone else who uses ammunition of medium or large size

When a carterdge is being loaded with powder at the factory, a small amount of free space generally is left in the powder compartment so that, when the bullet is pushed into place, there will



the gun, thereby breaking an electrical cyrcuit

be no danger of its jamming against the powder grains. Therefore, by twisting and turning the cartridge, the powder can be made to change its position slightly. If the cartridge is held with builet end upward, and tapped gently on the back of the hand, as one would tap a cigarette, the powder will be compacted at the base. If the cartridge is held bullet end down, the powder grains will mass themselves against the bullet If the cartridge is laid on a flat surface, or placed between the bands and rolled, the powder will be distributed uniformly from one end to the other

When the firing pin strikes the primer, a jet of intensely but and fast-moving flame is projected through the powder mass. If the powder grains are close to the jet, they will be ignited more quickly than if the primer flame has to move a greater distance before striking the powder

All of which leads to the following deductions: If the powder is distributed evenly by roiling the cartridge normal ballistic results may be obtained. If it is compacted at the primer end, either in the manner described or by holding the gun upward, the pressure will be raised with a consequent increase in bullet velocity, and a flatter trajectory. If it is concentrated at the bullet end by tapping, or by pointing the gun downwards, a lower pressure, lower velocity, and more curved trajectory result.

The importance of the distribution of powder within the cartridge may be appreciated when it is realized that the velocity of a 30/06 builet shows considerable variation, depending upon the manner in which the cartridge is handled. Proper handling of the cartridge after tapping or rodling is quite important. It should be moved evenly and slowly into

A 04 8 W . 7 C V 65 4 24 5 . 5

MEASURES BAR-REL PRESSURE The strange device at the right is a equilibration gauge for measuring pressures at the various points on a gun barrel. As shown to tirtic, a lead plunger compresses a cyl oder of lead to indi-

cale the pressure set up by the powder

In the picture below, a cesearch worker is counting the shot holes made in a thirty inch circle in a shotgun-powder test



The force needed to pull a builet from a cariridge is measured by this toachine

a horizontal position, and inserted anto the firing champer without jar true. A jerk will cause the powder to be dislodged, and will cancel the effectiveness of the previous treatment. Although this is of little importance when shooting over short ranges, it might be noticeable in firing at longer ranges with high-velocity ammunition. This effect does not apply to 22-caliber ammunition, because of its smallness, or to shotgun shells and other cartridges not containing powder in loose form.

It is unlikely that the average shooter realizes the high degree of reliability of his powder. He is so accustomed to having every cartridge five when he pulls the trigger that he takes for granted the dependability of his ammunition. When ammunition is blamed for a missive the real reason usually can

be found in some part of the firearm; the failure is more likely to be

When a scientist attempts to study gurpowder he finds that he is facing various difficulties. Try to visualize one one-thousand h of a second. You wait find it impossible. Your mind simply cannot greep a time intervalso small. A series of motion-picture images, which generally are presented to your eyes at the comparatively slow rate of sixteen to twenty-four distinct pictures a second, give the effect of continuous action. A scientist working with gunpowder is con-

cerned with chemical reactions which occur in less than a thousandth of a second. To photograph a bullet that such reactions send through the air, he must use a camera with a shutter speed of something like one in literals of a second.

Consequently, the burning of the powder must be studied by use of such delcate instruments as the cathode-ray escillograph and the pieso-electric gauge which operate with more than lightninglike rapubly. Because of the extreme speed of the chemical reactions which occur when smakeless powder is burned, the temperature rises to a high point and returns so quickly that it cannot be measured directly. The time-pressure measurements, and a knowledge of the chemical relationships, enable the accentist, however to calculate such values accurately. When a cartridge is fired in a gun, an almost endless number of variable factors affect the motion of the bullet. The manner of agnition, heat absorption of near-by metal, effectiveness of the gas seal between the bullet and barrel, friction effects, type of rafling, and a long list of other matters all are important

The common method of measuring pressure developed by a charge of powder is an old one, yet is sufficiently accurate for routine tests. To make a pressure-testing set-up a hole is drilled in a standard rifle harrel a short distance from the rear end of the cartridge chamber. This distance will vary for guns of different caliber; it is exactly one inch for a 30 '06 cartridge for the Springfield rifle. In this hole is placed a bushing which carries a hole in which (Continued on page 105)

Behind the Scenes of British Radio

HEN buildings crash, sirplanes drone, or motor cycles coar, in a radio drama, the source of the sound is seldom what it seems to listeners-in. Pictures on this page show the ingenious means employed by British broadcasters to make their programs realistic. The illustrations contrast the effect obtained with the artifice, often a surprisingly simple one, employed by the radio technicians to produce it. Experiments determine the placing of the microphone for proper volume





ROAR OF THE WAVES A drum containing lead shot, slowly rocked before the microphone gives a very realistic intention of what the wild waves only an they bent on the shore

A RADIO SARTHQUAKE The sercifying rumb's of an earthquake, as you bear it on the radio, may come from he che si ding down a sanded board onto the head of a hear drum



A HEAVY RAIN When the secretaring rain the illusion is produced by pour ingriculation a backet fixed with crumpled paper as in above above

MOTOR CYCLES
The noise of a recing motor cycle of
simulated by holding a piece of heavy
paper against a revolving dish bearing
though of leacher





AIRPLANE MOISES. To reproduce the sound of an eirplace crash, radio technicisms smash a match host and teac heavy paper close to the microphone, as in the top picture. The drone of a flying piene is mitsied by holding a drum to that its head is struck by though on a revolving disk



In these soundproof cages, haby constres were reseed for studies in psychology. The air pipes have balfice to resp sounds

Curious Tests with Canaries

SOLVE MYSTERIES OF HEREDITY

OES your success in life depend upon the brains you are born with, or upon the things you are taught as you grow older? Canary bieds, living in the padded depths of soundproof cages in the University of Southern California's psychological laboratory, are beloing scientists to find the answer. In a series of remarkable tests of which the first bas just been completed the canaries are ending a long-standing controversy by showing what relative parts heredity and environment play in shaping the traits of an individual.

In their first test, investigators sought to determine how considers learn the complicated songs known as "rolls" and "tours." Do the baby birds imitate the songs they hear their parents sing, or is their singular ability laborn? Experimenters placed a dozen infant birds, almost as soon as hatched, in padded cages where no sound could enter. Air-conditioning equipment made artificial weather, supplying warmed or cooled air to the cages according to the season. Baffles trapped any sounds that might enter through the air papes. Each cage contained a microphone, enabling the scientists to cavesdrop upon the birds.

Months passed while an automatic sound secorder detected nothing his sporadic chirping. Then, virtually overnight, all the birds began singing. Headphones clamped to ears, the scientists listened spellbound to the computated songs that delight canary lovers. To prove what they heard,

they made to on phonograph d	
	ABS AS BOX O

Bloodhounds

By LEON F. WHITNEY

ATE one evening, last summer a longd stance call reached me tront Cromwell Conn. A two-year-old haby had disappeared while its mother was picking blueserries, and 700 searchers had combed the fields without success. Would my bloodbounds join the hant?

The war contribution of the factor of the fa

It was after midnight when Jack and Toughey two of my best traders, scrambled from the car at the scene. Lake tire flies the flash lights and anterns of searchers were flickering in the fields beyond, and in front of the house for half a mile the road was so id with parked cars. It took us three hours to get the people back so the dogs could work unhampered. Then, I gave them a smell of the baby's sun suit and commanded "Find". With noses to the ground they started out.

The first step in trailing with bloodhounds in to g we the dog a set of some art ple that has been handled by the purson sought

When training begins, the holding strap to unbooked from the collar and snapped onto the harness, as shown above. In the princes, as shown above. In the princes at the right, the dogs' heads are being held up from the ground until they reach the spot where the lost person is known to have been at one time. This is done to prevent laste starts

Trailing over a stone wall. For practice runs, boys are bired to lead the dogs over courses up to five miles, many every possible trick to throw them off the accest



Insta gl hun i
pen nen e en
pun nan w uva O a
b a ban ve e e a e 1
h e g han see d
a ha Thep para men
ha such a d g e a g
l e e pub nante gree

A fast trail is usually a cross-country run, Try walking behind two tugging, 100-jound dogs, and your heels are jarred back and blue. With a State Police officer and the father of the lost third behind me I skirted a nursery and entered a sund pit. Here, the dogs arganged and triescrossed as though they had gone crazy. A few days before, the baby had played in the pit and the dogs were following the maze of tracks in the sand Suddenly, Toughey lifted his nose in

Suddenly, Toughey lifted his nose in the air standing almost on tiptoe to sufficient at Jack to ewid sure A mornion law were purposed across at the reagh he reports and not take the way, the animals dived into the door and rushed into the building. Nearly half a mide away, and through the scent of more than 200 living people clustered outside the house these were madings had easily the house these were made as a second

I was that are heart of The mys carry outside starte on a brough the crease the state of the complete the sport where the solver was spending her best as here here a see a set, towar a swarp. The righ 6, 3 () 1 or and a year row was the light was stee king the east when this ero. I A untuge and vector in a the coras, two ferns and water. I knew we were very close to the child, from the way the dogs held their beads up and sniffed. We held them back until we could see a little better The father called the baby's name over and over. There was no response It seemed certain the child was drawned.

As soon as it was light we found the baby a few feet away. She was sitting up to her waist in water too numb to answer her father's cad, but otherwise unharmed. Seven hundred searchers had not thought of looking in that direction, but the keen noses of the broodhounds had traved her and saved her life.

N ne times, last summer alone, my dogs

found chadren and old people who were lost. Counting with groose chases, we were in action on an average of once every five days. The distance we covered in our runs must have totated hundreds of males.

Probably no animal to the world is more misunderstood than the bloodhound. In the popular mind, the animals are victous brutes that trail and attack their quarry. As a matter of fact they are among the most gentle harmless dogs known. Trailing is a game with them, and they haven't the sughtest ill will toward the ones they follow.

Several years ago, in Kentucky, a long

a waste patch. At this moment both mentripped over a root and crashed to the ground breaking the lantern. They were left in pitch darkness, while the dog rushed ahead.

as an one hase Themas ore any shows the none

shim of a bio abdone puppy a characteristic tra-

Striking matches they pushed slowly through bushes and briars. Finally, they heard a cooing gurde ahead. It was the baby her dress he d fast in a tangle of brambies. One of her arms was around Nick Carter's neck and the dog was licking her face doing his best to comfort her

"Unite Tom's Cabin" is probably most to blame for the popular misconception of the nature of (Continued on page 100)





search for a lost thild ended with a dramatic exhibition of the inherent kindliness

A little girl was last seen playing with her pet dog near the bank of a rivor. At evening, the dog returned without the chair. All night, the neighbors searched in vain and in the morning they began dragging the river. Twenty-seven hours after the resupportant of the inhibit was 1s covered. Capt. V. G. Mallikin, in his lifetime one of the greatest bloodhound men in America, reached the spot with his

Tha noted "still tracer," who followed a track without a sound, immediately swing away from the river nose to ground Mainkin and the father of the child, with a lastern, ran behind the Itaging dog. On the other side of a hill the Itanied toward.

of the bloodbound.

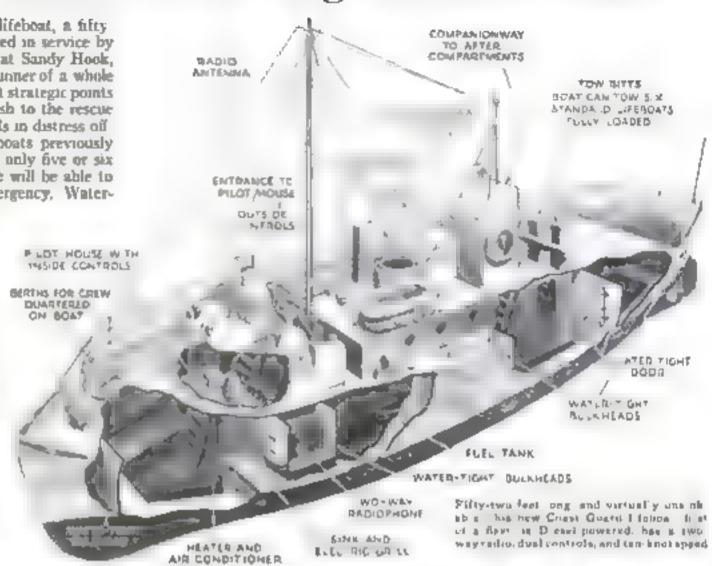
celebrated dog, Nick Carter

JULY, 1933

Coast Guard Gets Big Rescue Boat

CALLED the world's largest lifebout, a fifty two-foot craft recently placed in service by the United States Coast Guard at Sandy Hook, N J., is expected to be the forerunner of a whole fleet of stimular craft. Stationed at strategic points along the coastline, they will dash to the rescue of passengers and crews of vessels in distress off shore. In contrast to smaller boats previously used, which could accommodate only five or six survivors at a trip, the new type will be able to take aboard 100 persons in an emergency. Water-

tight bulkheads make the boat virtually unankable, even in case of collision with drifting wreckage. A 150-horsepower Diesel engine drives the craft at a speed of ten knots, and two-way radio equipment is provided with a transmitting racius of about 150 miles. A crew of twelve handle the craft which is controlled from an outside bridge in fair weather and from a pilot bouse, with duplicate controls, during a storm. The engine room, in which thirty persons can stand is air-conditioned, as are other parts of the boat. The craft is also egaipped with an advop after fire-extinguishing system. The boat is named Invincible





NEW WIRED-RADIO SET

Wittep radio—the transmission of programs to homes along electric light and power wires instead of over the ether—took another step forward the other day with the demonstration at Lakewood, N. J., of a receiver designed especially for the reception of the "broadcasts." Illustrated above, the receiver is housed in a cabinet about the size of a radiator enclosure, and hinged panels afford access to the control knobs. Wired radio has the advantage of freedom from static. Patrons may contract for any type of program desired.



More than 750 feet of track were used in building this realistic model of a two-level radway system

Sails Aid Storm-Tossed Steamers

BY EQUIPPING three of his newest steamers with fore-and-aft sails, a prominent British shipowner is leading a return to sea styles of long ago. For sails, generally considered obsolete since the advent of steampropulsion, are making a come-back upon "tramps" and other small steamships. Countless marine disasters have taught the lesson that a vessel of this class cannot depend on steam alone for safety in a storm—especially when the ship is forced to heave to, or abandon its course and he headed almost directly into the waves.

So long as a ship can maintain this position, it rises and falls as the waves roll under it, but no damage is done, In this situation, a steamship must keep its acrews turning to maintain enough headway or steerageway for the rudder to take effect and hold the ship at the proper angle. But when mountainous seas lift the rudder and propeller clear of the water, the vessel no longer can be controlled, and hes at the mercy of the storm. Swept. into the trough of the sea, it is buttered by waves crashing over it broadside. Serious damage, or even the loss of the ship, may result,

All this is changed when the ship is fitted with sails. It is a simple matter to adjust sails so that the fateral pressure of the wind holds a ship at the correct angle after heaving to, without recourse to sudder or propeller. Even before it becomes necessary to heave to, the use of auxiliary sail on a steam vessel relieves the strain on the sudder and ressens the peril of broken steering year. It

DEPENDING ON STRAM ALONE,
A VESSEL CLAN NO CONGER MAIN A
STEERABEWAY WHEN HE ON SE
RUDOER AND PROPELLER FROM 30-41-12
RUDOER FROM 30-41

also reduces dangerous rolling. For these reasons Sir Arthur Rostron, for mer commodore of the Cunard Line recently advocated the use of auxiliary sails on all steam vessels up to 4 000 tons. Edmond Walts, British shipowner, promptly adopted the suggestion for his newest trait



Drawing shows how sails garegoard one I steamers

THIS TIME THE RIVER IS PUT UNDER THE BRIDGE

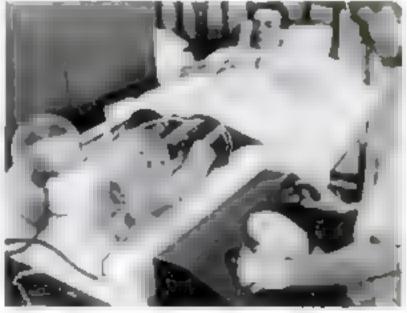
PUT

BUILDING a bridge on dry land, and then putting a river under it. was an unusual engineering feat recently begun at South Omaha, Neb. When the government undertook to make the upper part of the Missouri River navigable, engineers decided to force the river back into an old channel that it had deserted some years before. It was also decided to erect a bridge at this point Nearly finished at this writing the bridge stands on dry ground

This is the bridge.
It spans a dry charner into which the
M about River
will be turned.
Then the unfiniabed approach
will be completed

And this is the river in its present channel, which will be bruched by diven to force the stream tander the bridge





Petrent's feet subjected to low air pressure in glass boots

GLASS BOOTS NEW MEDICAL AID

Hight-altitude conditions, beneficial to sufferers from artenosclerosis, or hardening of the arteries, are reproduced synthetically in a New York hospital where one of the latest types of medical apparatus has just been installed. The device consists of a pair of "glass boots" in which the patient's feet and legs are encased. When a vacuum pump is set in operation, the atmospheric pressure inside the boots may be reduced to a degree comparable with that at any given elevation above sea level, and this lessening of external pressure permits improved circulation in the affected limbs. The photograph above shows a patient receiving the treatment while an attendant regulates the pressure

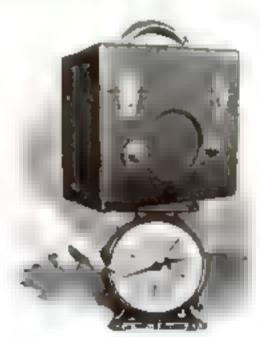
Floating Dry Dock Serves Seaplanes



Below, remarkable floating dry dock for seaplanes, which submerges to take aircraft abourd. Left, two scapitates blocked up on the vessel's deck for repairs to pootoons and dodercarriages.

A 1,000-ron floating dry dock for seaplanes is a recent innovation at the base at Pembroke, England, where no "supway" is available to baul the aircraft from the water when repairs are required. When the floating structure is submerged, an operation requiring twenty minutes, it can take aboard scaplanes of any draft up to seven feet. With indevency restored the dock raises a plane high and dry so that the pontoins and other parts of the undecenting are readly accessible to workmen for any repairs that may be neces-

sary. A folly equipped workshop occupies the space nerow decks together with accommodations for the crew of naneteen. The illustrations above show a pair of scapitaties blocked up for overhapling, and a general view of the dry dock as it appears in service. Constructed on he incoof a ship, the anasual dry dock can be moved from place to place to meet demands for its services.



COMPACT RADIO-PHONOGRAPH

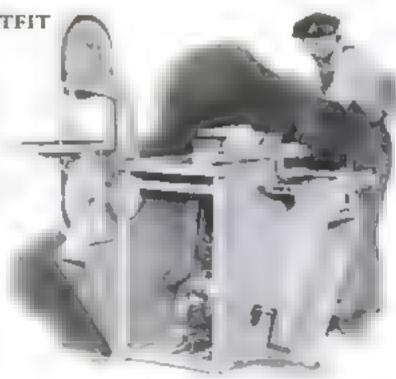
Rapto and phonograph are combined in a compact portable set which weighs less than fourteen pounds. A tiny electric motor rotales the phonograph turntable. The radio receiver used both for picking up broadcasts and for reproducing phonograph recordings, employs a five-tube superheterodyne circuit.

PREDICT HIGHER PLANE SPEED

Species of 500 miles at hour or more for commercial airplanes in the near future are forecast by chemists as a result of the development of new types of gasoline, already under test which are expected to provide an unprecedented output of power



MOUNTED on skids, a new portable saw oufit for bome mechanics, carpenters, and contractors, shown at right is easily transported from one job to another. A gasome motor makes the device independent of electrical supply It comprises a large table with a circular saw and side benches with a band saw and a jointer, while at tachments for boring rout ing, and other purposes may be added as desired. As many as four men may use the unit at one time, according to the maker,



SEALS TRANSPARENT BAGS

Hosta candy makers and others venturing into small-scale commercial enterprises may now put up their products in containers of professional appearance with the introduction of a machine for sea ingsmall objects in bags of glassine or cellulose-tissue type. Using no adhesive, the device employs heat alone to stick together the opening of each bag. A fact pedal clamps together the paws scaling and crimping the edges of the bag in a single foolproof operation. Electric Organs Marketed

Rayboard of commercial electric organ, with draw bars by means of which over tooms may be added for apecial affects

RGANS that produce their tones electrically, long the subject of intensive isboratory experiment, are now available to the public. Compact and no more expensive than fine pranes, they provide all the effects of pipe organs and many new ones as well. A model just placed on the market, for home use, employs a console that takes up less space than an upright mano. A small auxibary power cabinet contains two inudspeakers that render audible the tones generated by mechanism within the console The artificial sounds are produced by rotating ninety-one thin, many-sided plates or "tone wheels," one for each pitch, be fore electromagnets, and amplifying the electrical disturbances prospered Small draw bars on the console keyboard may be pre-set to max overtones with each note that is atruck, in any desired proportion and enable the timbre of flute, diaposon



NOZZLE GIVES PROPELLER MORE POWER

musical tone color

By enclosive a ship's propeller in a ring or notale, engineers have found it possible to improve the efficiency of high-speed acrews used in towhouse and semiar craft by from thirty to fifty percent. The accessory eliminates much of the power waste from slappage by giving the manies a better bute on the water. Towhouts on the rivers Elbe and Rhine in Germany have been the first to try the new pozzle.



Towbest equipped with propeller ring which increases its efficiency

NECKTIES OF WOOD

t savive "neckties" from wood is the hobby of a city park supervisor of Akron Oh.o Shaped, atmed, fitted with a satic bands, and worn with a regulation woodsman's uniform they preserve a neat appearance despite wind and weather,



DEVICE SHOOTS MARBLES

EVEX the time-honored pastime of marble shooting has tempted the ingenity of the inventor, and the mechanical marble shooter illustrated is the result. A plunger with a spring steel holder grips the marble, which is pulled back and released by a thumb button. According to the makers, the device adds sest to the game by combining speed with accuracy

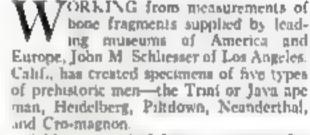


REALISTIC MODELS OF

Prehistoric Men

Made by New Casting Process

By ANDREW R. BOONE



Schliesser studied human anatomy for bree decades while practicing his profession of tandermist. Recently, having obtained bone fragments and estimates of size and appearance of ancient men from museums, he undertook to reproduce them

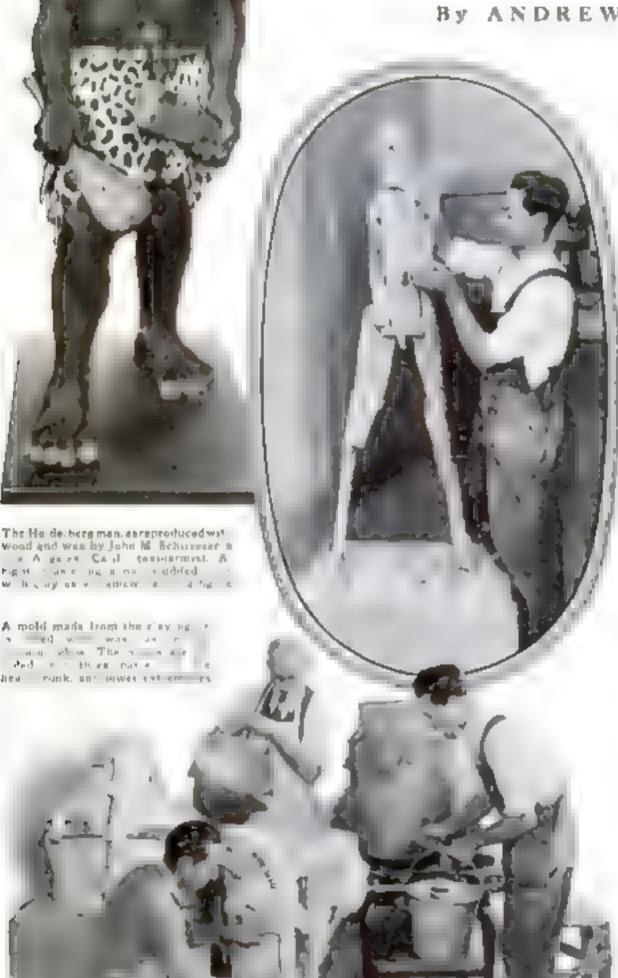
He started by cutting lengths of wood to represent principal body bones. These he bolted together in skeleton form. Over the skeletons he worked clay in accord with bone sizes, showing all muscles and details of the ancient human figure. Each head was made after he had measured a prehistoric skull with calipers to determine its size and contours

After the figures were modeled in clay Schliesser cast them in plaster forms separating the molds into three parts, one for the lower body and bribs, another for upper body, and a third for the head The bodies proper then were "poured by filling the moulds with French beegwax, properly colured for the race to be represented. This was, hardened by a secret process, will not melt at ordinary atmospheric temperatures.

After grafting the head into place with melted war, Schliesser acraped and sandpapered the bodies to a saim finish. He imitated profuse growths of hair by inserting, singly and in groups of two to four, human hair into the bother, on faces and heads. For this delicate process he employed two sewing needles from the beads of which the crowns had been broken, thus providing small two-lined forks. When finally the hair was smoothed and faces tinted, the figures were complete.

The five figures, representing races which once existed in various parts of the world, reveal the beginnings of intelligence. The ape man had no implements. The Heidelberg man learned to wear sions. Pittdown not only made clothing of skins, but slept on beds of skins. Neanderthal used implements made from rocks and lived in caves guarded by revolving rock doors. The Cro-magnon man possessed weapons of greater haling power and wore wrap-around shoes

Schliesser's shop is a veritable wonderland filled with the stuffed and mounted figures of birds, animals, and reptiles. One of his specimens is a stuffed embryo whale





HUMPBACKED CARS USED ON INCLINE



Passengers are not posted by hill climbing in these odd cars, since the sages are always level.

H. MRRACKED trodeys now carry tourists up and down the hill on which the Mon marte section of Paris France is situated. Because of the extreme steepness of the grade, the cars rest upon in-

DOLLY CARRIES

PROPELLERS.

most awkward loads am-

aging de-a pair of three

bladet airplane propt lers weighing 700 pounds—

the dolly illustrated at right has been devised by

mechanics of a transcon-

t nenta, air inc. When a plane to la in at the main-

tenance base for over-

boal the runber-tired cart

enables one man to habl

the big "props" from the air ones to the shops and

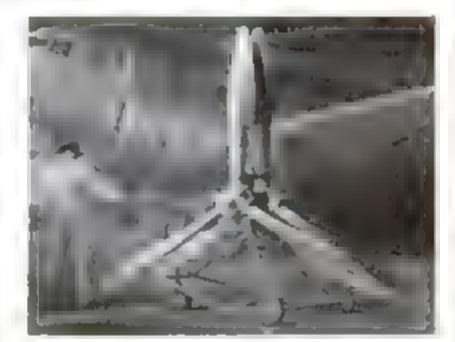
back again, without dan

ger of damage Former v

three men were needer

To CARRY one of the

t med under arriages in order to keep the seats level. The new equipment marks the resumption of service on the short tail-road, which for some time was discontinued.



Merhanic hauling heavy transport-place propellers on dolly

Odd Mexican fish which have two pairs of ayes



FOUR-EYED FISH SEE ABOVE AND BELOW WATER

A Path of four-eyed fish from Southern Mexico first of their kind ever brough to this country recently went on exhibition at the American Museum of Natural History in New York City Swimming along the surface of the water, the fish use one pair of their eyes to watch what is going on above while the other pair in directed in the water beneath them. The air-and water-eyes have separate relinus out use the same lenses, a different part of the same bulging lens serving for each, as shown in the diagram above

SWISS POWER PLANT HAS HIGHEST MAN-MADE FALL

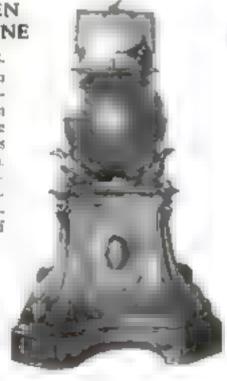
As antisteral waterfall more than a male high drives turbines in a new Swiss by develocity, plant. Through rugge, metal concasts, the water drops a distance of 5-41 feet, and as traveling at a specific seventy makes an hour by the time it has the turbine blacks. These sand in we the highest manipulate waterfall in the work a though the volume of water is smill as compared with other by roclee ricipants.

TINY STATUETTE HOLDS PEN IN ANCIENT WRITING MACHINE

A strance machine believed to be the grand-daddy of the modern typewriter, built by an ingenious craftsman in 1760, has just been uncarthed and displayed in Vienna, Austria. When its levers were manipulated, a quill pen in the hand of an animated traine wrote script letters upon paper. The operating train of mechanism of staggering complexity, was housed in folding segments that closed to form an ornamental globe. The figure holding the pen is behaved to have been intended as a likeness of the reigning Empress.

TEST ROADS IN COLORS

Colored concrete, said to reduce the glare of sunlight during the day and the reflected dazele of bendlights at night, is being tried out on highways in England.





Strange writing machine, showing statuette, ped, and paper at top, and left, the complicated parts assembled



SOME CATERPILLARS increase in size 10,000 times in thirty days

NATURE takes 100 years to produce an inch of fertile topsoil

K-TE FLYING has been outlawed in Shanghas, Chino, becouse of the danger to sirplane priots.

COWS have better memories than horses.



TH ATEEN PASSENGERS can side in a two-and-a-half-ton searing plane now under construction in Russia.

PREHISTORIC LIZARD tracks 225,000,000 years old, have been found in the heart of the business district of Lincoln, Neb.

PAPER CLPS were used by sigeous in New York City to build a nest on a window ledge.



SJNLIGHT strikes the Rock of Remembrance in the new War Memorial at Melbourne. Australia, only once a year at 11 AM. November 11, the exact mamont the armistics, anding the World War, went into effect.

APPLE TREES are attached by 176 hinds of intect posts. Five hundred hinds attach onks.

WALRUSES are their tasks to dig up clams from the sea bottom.



BIRDS have three eyelids.

VISITORS at the 1934 Chicago World's Fair consumed 2,000,000 has dogs, 4,600,000 humburger sandurches and 2,000,000 quarts of coffee.

WHITE CANES for blind pedestrians are required by an ordinance proposed in East Orange, N. J.

WOODEN SHOES are manufactured and sold in the United States at the rate of approximately 1,000,000 pairs a year.





Reflector button in recess in curb of highway

REFLECTORS IN CURBS MARK SIDES OF HIGHWAY

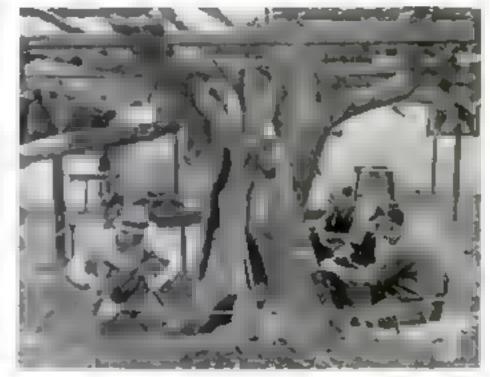
Reflecting bottons set into the curbs of a highway are being tested in England as a protection for motorists driving on dark or foggy nights. Colored red and white, the reflectors gleam in the rays of an approaching automobile's headlamps, clearly showing the boundaries of the paved surface and preventing a driver from running off the road. Set in recesses, the reflectors face an approaching car

CUTS BRAIN NERVES TO CURE STRANGE DISEASE

By curring half way through certain nerves in the brain, Dr. Walter E. Dandy, noted Baltimore, Md., surgeon, has been able to cure Meniere's disease, a puzzling affliction which produces severe spells of discussed.

SURGEONS SEEK TO SAVE FAMOUS VINE

TREE SURGERY was applied to a grape vine for the first time when experts treated and hiled the cavities of the famous ord Ramona Vine, at San Gabriel, Cabi, in an effort to save it from destruction from the combined effects of dead wood and termite attacks. The 164-year-old vine, with n central stem that rivals a tree trunk in size, is supported by an arline covering half an acre, and nitracis thousands of tourists every year



True surgeons at work on the Remona grope wine at San Gabriel. Calif.



Editing home movies with aid of a new device tiess engagements.

HELPS TO EDIT HOME MOVIES To AD in editing home movies, a new de-

To are in editing home movies, a new device winds the film slowly over a brilliantly alluminated aperture. Through a powerful magnifier, the film images are seen greatly enlarged. Small guntimed stickers are attached to mark the end of each scene, making cutting and splicing easy when the scenes have been listed. The device has a built-in aplicer, a film-cleasing attachment, and two rewind speeds. It handles film of either eight- or sixteen-millimeter size

WATCH ON IGNITION KEY

A MIDGET watch serves as a handle for a novel ignation key designed by a Westwood, N. J., inventor. Handy for auto tourists, it

may be removed and carried in the pocket or stood on a hotel dresser, while on the road it serves as an automobile clock as shown in the illustration, beloing its owner to keep busibess engagements.



ELECTRIFIED MEGAPHONE HELPS TO TRAIN CREWS

Whispens are transformed into shouts by an electric megaphone invented in England. When the user speaks into the mouthpiece, his voice, amplified many times by electricity, comes booming from the flared end. The device has been adapted by the rowing coach of Cambridge University to make his instructions carry across the water to the crews of racing shells during the period of training that precedes a regatin.

SPOON HOLDS MEDICINE WITHOUT SPILLING

Pourtyo out a teaspoonful of medicine is made less of a jugging feat by a new spoon with a measuring cup built into its bowl. When the spoon is held vertically, it may be filled and carried across a room.

if need be, without danger of spilling Held borlaontally, the spoon may be used in the ordinary way. The convenient utensil is especially for use in sick room or bospital where it frequently is necessary to carry a measured amount.



NAIL HAS TWO HEADS

A NAIL with two heads has just been introduced for assembling forms, staging, and all types of temporary construction. Its square lower head, one half inch



Hammerclawcens ways

square, permits the nail to be draven home with force enough to hold the forms tightly. An upper head remains projecting, affording a convenient grip to pull out the nail when it has served its purpose and preventing damage to the lumber in the process. Both can be used again.

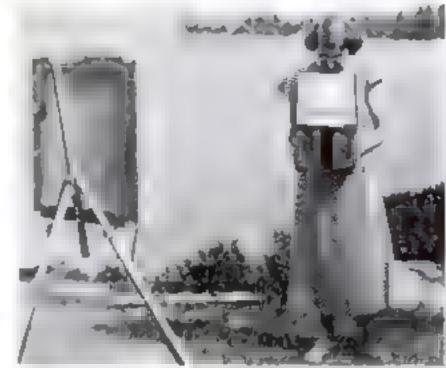
VIEW BOXES REVEAL ARTISTS' ERRORS



The wall-eyed camera which compares a picture with its subject

A"camera" for artists, devised by a Hoot hbuy Harbor Me., instructor, and students to grasp the fundamental prin-

ciples of color and perspective. The device comprises a pair of boxes hinged together each one having a lens and mirror so arranged as to throw an upright image upon a translucent screen. One of the lenses



For comparison, artist points one box at score, the other at canvas

as trained upon the scene being painted and the other upon the canvas on which the novice is working so that the student sees the landscape and the reproduction of it side by side, and can rectify mistakes.

BICYCLE CARRIES LOCK IN ITS HANDLEBAR

A TREE, a samp post, or a telephone pose makes an effective hitching post for a hitching country and fearible steel cable is with drawn from its place in the handlebar nan around any fixed object, and plugged into a socket on the frame, the bike is there to stay until the owner returns with his key. The device is calculated to balk even a thief enterprising enough to carry away a bicycle with a padiocked wheel

ROBOT TELEPHONESPOLICE

A sonot that alently lifts the receiver and telephones the police if a burglar enters the house has been invented by a Bruish experimenter. Attached to an ordinary telephone, the automatic apparatus is contained in a small box which can be secreted in an inconspicuous piace in the house. As the burglar opens a window or door, he trips the alarm, lifting the telephone receiver and setting a small phonograph record turning.



How new steel-cubic buryels lock is fortened

OPEN-DECK FERRY IS UNUSUALLY ROOMY

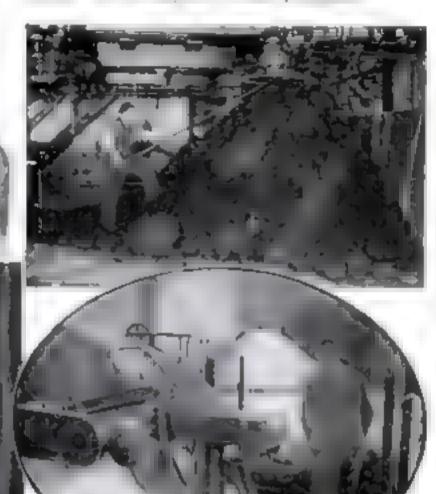
Pt MPKIN SEED ferryboats, providing virtually unobstructed deck space for transporting automobiles, are a recent invention. Because of the compact engine-room ar rangements of the Diesel-driven craft, each is able to accommodate thirty-four cars. Two of the new 125-foot

boots have just been placed in service to ferry vehicles across the Panama Canal as a link in a main highway



CATTLE FODDER MADE FROM WOOD PULP

Systemetic food made from sawdust soon may enter the reason of commerce. Expense it is have also a succeeder in treatments in a cast a fooder. Now Dr. Friedrich Bergals, telebrate, it trains on mest as device on one the points on a art of a st. Morah on thermany scrap fog art pt. and and decide in bage tanks where the non-entitle cellulose of the wood with med in the first trains of the kind of the wood in the first trains and the present of the word in the first trains and decide with the more food of the wood.



Surface in a German plant where won fire transformed into fire a care on each of the special transformer has been appropriately transformer and the special and the second and the second



Line an oversize basketball in a monster gymnasium, a globular flying machine recently bobbed about in the great dirigible hangar at Orly, France, under the control of Etienne Ochmichen, noted French inventor. One vertical ascent took it to a height of fifty feet, where it hovered matanness, its four propellers buxung, for a full minute. The odd craft represents the latest of Ochmichen's many attempts to create a successful belicopter, or beavter-than-air machine capable of rising straight up. The purpose of the seventeen foot globe is not to lighten the craft but to give it stability-the great problem of hebcopter builders. This sphere actually adds to the weight of the machine, since it is filled only with air However, the globe resists any sudden overturning tendency, and points the way, Ochmichen believes, to a practical belieopter design. The illustration shows how the odd craft would look in actual flight,



The frame of the partable dressing took is actuated by a spring which raises the fabric envelope to afford complete privacy anywhere

FOLDING DRESSING ROOM

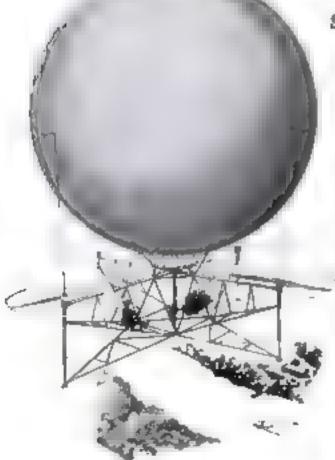
SET UP anywhere, a portable dressing booth for bathers offers complete privacy when extended, and folds to small space for carrying. The "jack-in-the-box" frame of metal is actuated by springs that ruse the fabric envelope to full six-foot height when hooks holding it in collapsed position are released.

PIANO IS AN ORCHESTRA

Propuring the effect of a piano accompanied by violent and celege, a novel instrument designed by a Tules, Okla., inventor employs a motor-driven, roun-covered roller as a bow. Taut cords, drawn against the roller, communicate their vibrations to the piano strings.



A navel pinon which plays the own violin accompunitional. Violin-tons mechanism is seen in circle





STEAM WIND VANE AIDS NAVY FLIERS

A jet of steam, released at the bow of the British airpiane carner Eagle, shows phots when the wind direct on is right for a take-off. Unlike the trailing wind cones seen at airports, the white plame of vapor presents no physical ob-

struction—an important advantage where clear deck space is at a premium. The photograph shows a plane leaving the carrier safely as the latter heads almost directly into the wind. A cross wind would make the take-off hazardous.

WASPS FLOAT PREY HOME

HUNTING wasps that paralyze spiders and then float them downstream to their nests were recently observed in action by a Missouri entomologist. The wasps dragged their prey to the stream and into the water, letting the spiders float on the surface while they flew along towing them in the direction of their nests. In this way, they reduced the labor of getting the spiders home. This phenomenon section has been observed scientifically



ROSES HAVE TWELVE-FOOT STEMS

ROSE BLOSSOMS With twelve-foot stems were a novelty exhibited by a Council Bluffs, Iowa, florist at a recent flower show. By destroying thousands of other roses, he produced fifty of these rivals to Jack's famous beenstalk Starting a year in advance, be proched off each shoot upon a peant that threatened to flower, forcing each hush to send its stack higher and higher. Eventually wire braces were peeded. When they finally hit the ceiling, the florist let hem bloom. The photograph shows bron with one of his remarkable creations.



These new masks give college beauty complete factal protection

PHONOGRAPH NEEDLES IN NON-SPILL PACK

REPLACING a used phonograph needle is made easy and convenient by a new dispenser that ejects one at a time. The handy device, manipulated as shown in the photograph, ends the nuisance of spilled needles and pricked fingers, familiar to users of the standard paper packages. With the new device, the desired needle simply drops into the paint of the hand. It can then be picked up easily between index finger and thumb and inserted in its proper place in the machine.



Shaking package ejects needles eing 'y, as shown

WEIRD MASKS PROTECT COLLEGE BOXERS' FACES

Boxzes with visages like legendary gobins now trade punches at the College of the City of New York, wearing odd masks designed for intercollegiate bouts by Dr. Canute Hansen, director of physica educat on. The devices, he reports, effectively prevent physical injuries and disfigurements such as have caused boxing to be permanently banned at many educational institutions. Two of the unu sual protectors are shown at the left.

"GRAVEYARD" TESTS WOOD DURABILITY

Rows of wooden posts, implanted like cemetery markers in a held adjoining the Forest Products Research Laboratory near London, England, are showing scientists how to erect buildings that will withstand weather extremes and the attacks of insect pests. Prolonged exposure of carefully labeled samples, in the "graveyard," pernuts the experimenters to determine the relative durability of different kinds of wood by actual exposure.



Samples of wood under test for resistance to wrather and vermin

BREAKS IN BRIDGE PERMIT EXPANSION



Tower leg of bridge, showing crack which permits expected to expand

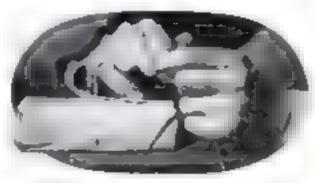
Forgow the crack in the center of the lower leg supporting this section of the San Francisco-Oak land Bay Bridge shown in the photograph, and you will find that it goes through the entire bridge structure, incluthing the lower and top decks. The split is no accident or mistake of engineers, but is one of the carefully planned expansion joints that permut the steel framework of the massive structure to expand along its length on hot days and contract on cool ones. Sliding decking covers the gaps. If the joints were not provided the steel members would inevitably buckle or tear apart under the terrific strains set up by any sudden changes in the Temperature.



Compact pochas enfery rasur assembled for use

FOUNTAIN-PEN RAZOR FITS IN THE POCKET

A pocker safety cazor no bulkier than a fountain pen, which it closely resembles has just been introduced. To open it for use. a cap at one end is unscrewed and the handle, with the crosshead clipped to it, withdrawn. The head is then screwed in place and the razor is ready for service.



NEW RING CUTS STRING

Provided with a built in string cutter, a new finger ring serves a useful as well as a decorative purpose. The sharp cutting edge lies recessed beneath the face of the ring, where it comes into instant play when a length of cord twine, or thread is drawn taut in the slot.

ROBOT TELLS TRAVELERS WHEN NEXT TRAIN GOES

As accommended at the Victoria Station in London, England, provides convenient and for the bewaldered traveler. When he punches a button corresponding to the station to which he wants to go, he receives a printed card showing at what time the next train leaves, and thus is spared the labor of puzzling over a complicated time-table.



Traveler presses button to get train information

ODD WINDMILL BOAT RUNS ON AUTOGIRO PRINCIPLE

A Two-stance windmill, with vanes that may be adjusted to take advantages of changes in the wind, drives a new type of marine vehicle known as a "gyroboat" lovented by E. Burke Wilford, aeronautical engineer of Merson, Pa., the craft is reported to have attained a speed of eight miles an hour. It is said to incorporate aerodynamic principles minther to those previously employed by the inventor in his "gyroplane," an airpanne of the autogiro type with blades of adjustable pitch (P. S. M., Aug., '34, p. 47)

STUDIES FOSSILS WITH INFRA-RED RAYS

Invisible light is helping a scientist at Glasgow University, Scotland, Dr. John Walton, study prehistoric leaves found in coal. Dr Walton has discovered that infra-red rays, make the densest leaves transparent so that the fine detail of their inner structures can be photographed.



of the Wind

A hereest of broken umbrelles gathered from a New York City bidewalk after a heavy reinstorm which was accompanied by high winds

BLACK blazards of dust recently swept across the Middle West, From the Rockies to the Mississippi, from upper Kansas to the Tesas Fanhandse, the scourge left its trail In rolling clouds and sufficient billows, it blotted out the min, paralyzed traffic and buried fertile fields under a dufting blanket of dust

When scattered showers cut through the haze, cowboys were driving herds from dust-choked ranges, farmers were digging out wagons and tractors, and statisticians were calculating that, in wide areas, crops would be cut to drought-time proportions

In Kansas, alone, approximately 70,000,000 tons of dirt rode the winds from the western half of the state to eastern counties. Ninety-six miles of trucks, each hauling fifteen tons a day, It is estimated, would have to work for a solid year to return the soil transported by the breeze in less than a week. Dust damage in one kansas town of 1,500 inhabitants was put at \$10,800 or \$7.20 for each person in the community

A million-dollar Government was chest and 200,000 tractors, mobilized in Kansas, represent the initial move to fight the menace of wind-borne dust. In many areas, the fields will be "listed," or furrowed.

he drifting pariscles in check

Recent droughts and the plowing up of western grass lands during the war-time wheat boom, are largely responsible for present dust storms. In line with the Government program of replanting these grass areas, the U. S. Department of Agriculture last year introduced from abroad nearly 1.800 varieties of plants and grasses valuable for checking soil erosion.

When the dust blizzards were at their

height strange things occurred. Static elecricity, generated by the flying particles charged barbed wire forces, styled at a mobiles, and made men sand women a hair stand on end

Near Hutchinson, Kans., a contractor had taken the job of removing 10,000 cubec yards of dirt in connection with a county road project. His men had hardly loosened the earth when the dust storms swirled over them. The next day, they returned to the job. All the dirt was gone.



Fantastic tricks of rapidly moving air currents, once ascribed to supernatural causes, present new problems to science in protecting human life and property

By EDWIN TEALE

The wind had carried it completely away
Fantastic as that story sounds it is al
most commonplace beside other fact-tal
of queer, unbelievable things carried oft
by the wind. At various times and in v
rious parts of the country, minnows, to
ties, tadpoles, gold dust, eggs, bay, mue
not to mention trees, houses, and even a
horse and buggy, have ridden invisible air
currents through the sky

At Danville, Va., some years ago, seasheds fell from the sky and rattled on the roofs of houses during a downpour of ram and hall. Yet, Danville is 700 miles from the coast. The shells and fragments had traveled through the air all that distance after being picked up by violent, winds

along the beach.

Even more arrasing is an occurrence which took place at Bovina, Miss., about eight miles from Vicksburg, in 1894. During a hallstorm there, an ice-encased turtle plunged out of the clouds. It was eight inches long and six inches wide. Toused up and down by the turbulent air currents high above the ground, it had been turned into a living hallstone as layer after lay

of ice formed over its shell.

While most of these bizarre riders of the wind appear during storms, one of the strangest of all rained out of a clear sky on Baton Rouge
La. Early one Friday morning in the spring of 1896, pedestrians on their way to work were bewildered at the sight of hundreds of dead birds showering down out of a clear sky. Their bodies thumped on the sidewalks, rebounded from the mostopa, literally cluttered up the pavements. Cathirds, woodpeckers, wild ducks,—they fell in such numbers that 100 were picked up on a single avenue.

Among the theories advanced to explain this astonishing "birdfalt" the most plausible seems to be that



A Kenses Jarmer prepares to d g h s

A fresh of the wind-e small automobile under a tree which was dropped on it in a storm. The debties of a building to also part of the pile

the matrat of flocks were coughof a storm which had raged along we coast the day before and had win carried high in 0 the sky by a termic update. Here, either the him air of the arcuse rold kinet hem and later as they fill nic currents carried them over liaton Rouge

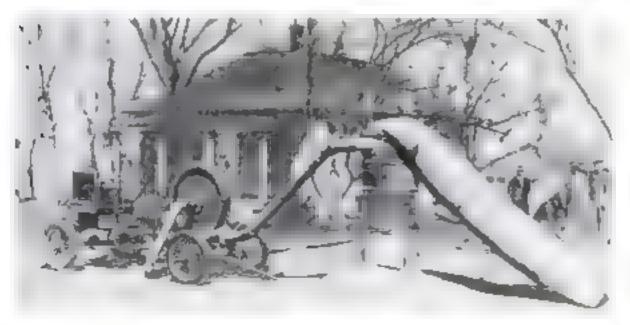
bered among the strange care as which have reduce me carrens for long distances through the sky. Not long ago, dust storms in California deposited tons of dirt in the streets of Los Angeles. An assayer scooped

up some and examined it. He found gold and silver dust which had come hundreds of miles from desert regions in the in-erior

Mud storms are comparatively common, Many occurred in the Middle West this spring after the dust blazzards had tilled the sky with particles of dirt. High above the ground, rain, combining with the dust, had formed the mud which fell in several communities.

In other cases, dust has conored raindrops and snowflakes, producing drifts of yellow or crimson snow and red rains which the superstitious people of the Middle Ages thought were rams of blood.

In England, several centuries ago, a whole countryside was terrified by a "rain of sulphur." Phosphorescent yellow particles drifted down through the air glowing weirdly in the dark. They coated houses and cov- (Continued on page 108)



A new business thrives in Kansas. Removing dust from a laws with a glast portable vacuum cleaner

Marvels of the Earthworm SHOWN BY YOUR MICROSCOPE



cigar in transparent to-sue probably thought he was doing something new but the lowly earth worm, the well-known fishing worm or Lumbricas terrestris, beat bien to it by countless thousands of years. For the earthworm, as dissection and your microscope will show, is wrapped in a thin, silky material of indescribable beauty

Doubtless you have tried to pull a footlong worm from its hole in the ground, and have been uston shed to find out how diffcuit it was. More than likely, when you pulled it broke in two instead of coming

To the person not on antimate terms with worms, the ability of Lumbrican to anchor itself to the sides of its hole in the earth is puzzing. Other actions of this humble animal are equally battling. For instance, When it is burrowing through the earth how does it keep the rear half of its body from slipping as it forces its slender snout forward, and how does it keep the front end from slitting back while the rear ball is being pulled forward?

Maybe you've guessed the answer: The worm has a remarkable system of tiny glass,ike "feet" or setae—four double rows of them along its body—which enable it to imitate a coarse-toothed file and to present a series of sharp points to the surface on which it is crawling. Your microscope will show these setue clearly, for they are fairly large, as microscopic objects go, being barely discernible to the naked eye against a dark background.

To see properly the pecultar wonders of the earthworm, you must become an earthworm surgeon, as it were. With scalpel and dissecting needle, you must open up the worm carefully, to reach the marvels that lie within. In doing this, you will be absorbing valuable knowledge about the structure of animals in general, for the earthworm is used almost universally as a model of the way in which pervous systems, circulatory systems, and other soölogical mechanisms function.

If you never before have dissected a specimen of animal life, you may find your first venture an introduction to a distinct hobby, one closely allied with interescopy It is by dissecting and examining all kinds of organisms that biologists and physiologists obtain their knowledge of structures of the lower animals, and even of man-

Get a good specimen, preferably a live worm so you can study its actions before putting it on the operating table. If the season or locality does not permit you to find your worms with a flash light at might, or in the daytime just after a rain, you can buy either live or preserved specimens from biological supply houses for about ten cents each.

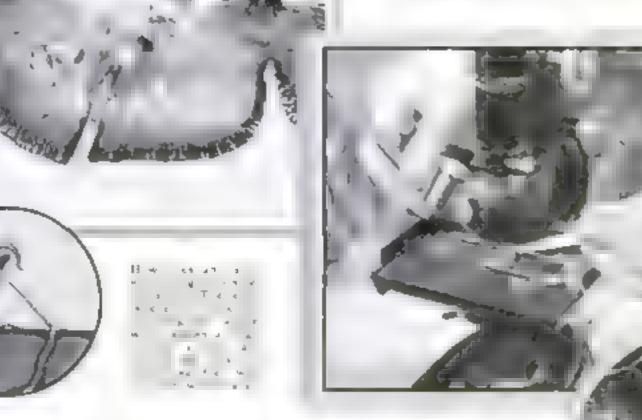
You will find the live worms covered with slimy mucus, excreted through tiny openings in the bodies. This mucus serves as a lubricant to enable the worms to crawlthrough the earth with case, and as a kind of cement to hold the walls of their burrows firm. The worms can be killed in a solution that is one tenth alcohol and nine tenths water. When the worm is dead, remove it, wash away any mucus and dirt clinging to it, and transfer it to the dissecting pan.

This is a shallow pan, costing about ten cents, into which paraffin is poured until it is three quarters of an inch from the top. Before melting the paraffin, however, solder L-shaped lugs of tin plate to the inner walls of the pan, arranging them so that they project one half inch or so toward the center. These lugs will anchor the paraffin "floor" in the pan. Otherwise, when water is poured into the pan, the paraffin cake will float. Melt the wax by setting the panon a stove, and then let it cool, being sure that the pan is perfectly level. If you darken the wax with lampbuck or powdered graphite, small bits of tissue will be seen against it more clearly than if it is left

Disserting is best done under water to which a little salt can be added, if desired. If the specimen is to be kept for several

By Morton C. Walling

lart mueberm apart to must eliber yow power Scarton, The ated outer d the worm a a made of ayers to this The phoograph be-Shows a proce o transparent e or wrapthe cove a dy Near the в весп ап E for ann of arine or ha set pala ng he sk n



With Scalpel and Dissecting Needle, You Can Pry into the Secrets of Animal Life as Exemplified in One of the Most Amazing Creations of Nature

days, pour over it a preserving solution made by adding about an ounce of fortypercent formaldebyde to a pint of water,

Have ready a dozen or more common pine. Put the worm on its belly, and push a pin through its shout, as near the end as possiale. Then, with the dissecting knife-which can be a safety razor blade fastened in a statable bandle-make a sharpwine sinn along the back, anglet y to one side of the middle. Cut just deep enough to penetrate the body wall, but not deep enough to cut the intestine and other organs that lie just beneath it. As your culting progresses, spread the body wall apart so that it lies flat on the paraffin, and stick pins through the edges, into the paraffin, to keep it fiat. You will have to use the scalpel carefully to loosen the internal organs so that the body wall may be spread out flat

THE structure of the ear hwarm, even though it is a relatively simple annual, is too complex to be described here in detail. Consult a good text as you proceed with dissecting.

When the first third of the worm is laid open, you will find that it contains a great many pieces of mechanism. Running from head to tail is the digestive system, made up progressively of the mouth, esophagus, crop, gizzard, and intestine. The intestine occupies the greatest part of the body length. Make a slit in it and remove, with tweezers, some of the material inside. Put it on a slide with a drop of water, and examine it through your microscope, to discover what the earthworm eats.

You can identify with ease shreds of grass and other vegetable material and grains of sand, which are commonly found.





Cross section of lower portion of the body of an earthwarm. Note how the nerve cord lies on the muscle tissue along floor of body cavity

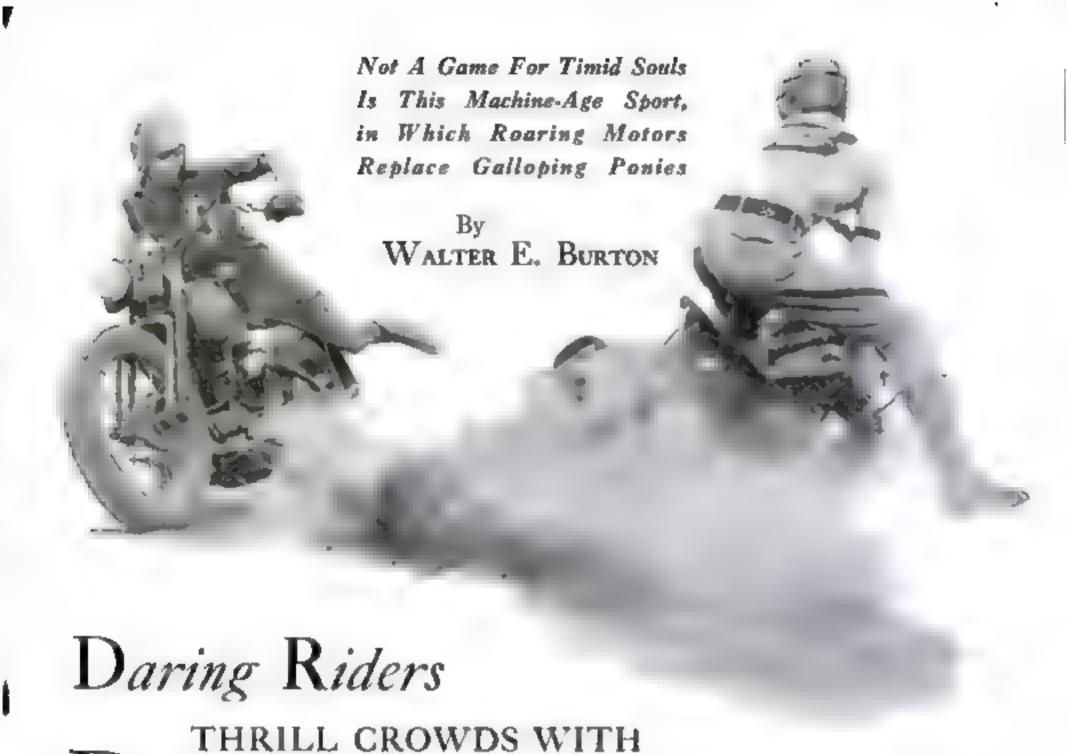


Post on of a cross sect on through an earthwarm showing how the upper partial the intert ness initialed to increase area

Keep that sand in mind, if you pun to make sections of the worm with a microtome

The earthworm, you will observe, is essentially a double tube. The inner tube is the digestive system and the outer the body wall. Between these tubes are various organs such as the nerves, blood vessels, reproductive oranis, of which the warm has both male and female; considerable muscular tissue, five pairs of hearts, and the nephidia or excretory or-

With fine-pointed sessors, clip a small square from the body wall. Put it on a slide, outer surface appearment, and a little water, and lay a clean cover glass over it. Examine the piece carefully with moderate power, say twenty-five to thirty-five diameters. Soon you will discover one of the tiny feet with which the earthworm grips the earth. These feet or setae occur in (Continued in page 94)



Polo on Motor Cycles

BEHIND a pair of slender goal posts at one end of a large field, five motor cycles are lined up abreast. The riders, tense with excitement, race their engines nously. Across the field, a bundred yards away a similar group stands waiting behind mother goal Exactly half why between the opposing teams, a referee places a

A timekeeper on the ground.

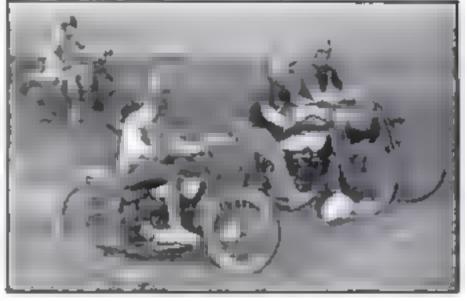
A timekeeper on the sidelines drops his yellow flag, the referee blows a shrill blast on his whistle. From one of the teams, a solitary rider darts forward and swerving a little to one side of the ball, gives it a resounding kick that sends it soaring through the air. Immediately there is a roar of exhausts as the other machines spring into action. A game of motor-cycle polo, one of the most exciting of modern sports, is under way

Polo on wheels is not a game for tunid souls. Ten men dashing about a field on motor cycles weighing more than a quarter of a ton each, half of them trying to kick the ball one way and half the other, do not give the impression that they are engaging in a parlor sport. Scarcely a minute goes by in a typical motor-pologame without an exciting spill or an in-

teresting tangle. Yet suspresingly few skinned shins or bent spokes result The fact that, on a restricted field and during normal play, there seldom is opportunity or necessity for a player to attain much speed. doubtless removes much of the danger from the sport Nevertheless there are few games, either on wheels or of that can rival motorcycle polo for thrills and action.

This comparatively new game is, as yet, known to only a few sections of the country. It is spreading in popularity, so that almost every community where there is a motor-cycle club doubtless will become acquainted with it in the near future

Although league and championship games are played in accordance with rules, and with equipment specified by the



A player following the ball across the field, with a permusto builds him and two members of the opposing team ready for a chance to interfere

American Motor-Cycle Association, the average contest between local players, or between cyclests from neighboring communities, frequently is highly informal. For instance, the regulation pole motor cycle is a machine stripped of much of its standard equipment, yet games often are played with stock machines which have not been altered in any way.

The regulation motor-cycle pulo field has maximum dimensions of 200 by 300 feet. Fourteen-loot goal posts, no larger than four inches in diameter, are placed twenty feet apart, at each end of the field. A semicircle with a radius extending out tharty-five feet from the center of the goal is drawn with time or other material, to indicate the goalkeeper's zone. In the exact center of the field is a circle, from which the kick-off is made, fifty feet from each goal is a penalty circle for making penalty kicks.

Only one-seated machines are used in regulation playing. A short guard is employed on the rear wheel, and none at all on the front wheel. For safety a sake chain guards are used front and rear. No skid chains are permitted on the tires

PIVE players constitute the usual team, although the game can be played with less. The line-up of players includes a center, right forward or guard, left forward or guard, rear guard, and gualkeeper. At the start of each play, these men line up in definite formation behind their proper goals. The center occupies the center position, with the right and left guards on either side, respectively. The rear guard is at the right of the line, and the goalkeeper at the left.

With the exception of the center who makes the kick-off, no player is permitted to leave his position until the boil has been booted or passed by the center rider. Then all except the goalkeepers move out on the field and try to force the ball between the opponents' goal posts. The goalkeepers move around to a position from which they can dash across in front of the goal to block the ball if it comes dangerously near

The goalkeeper is a privileged player Ho is permitted to block the ball with his feet, hands, head, body, or motor cycle as long as he remains on his man me and mays where the thirty is separately. Outside this can be may play the had only with a feet or machine. The other players must use only their feet to play the ball, although they may track it with heads, shoulders, or a bows. Blocking with the machines, using hands, or holding the ball with a foot make them hade to penalties

To see that these regulations are observed there is a battery of officials, including the referee, whose hardest job is to keep up with the players while he travels, of necessity, on foot, two assistant referees who take positions at each goal post to pass upon the success or failure of goal attempts; four impires, two from each side, who assist the referee, determine when a hall is out of bounds, and occasionally help restore a spilled inder to his mount. A time-keeper, with a yellow flag to signal beginning and end of each fifteen-minute quarter period, and a scorekeeper, are stationed at one side of the field. There is a five-minute intermission between quarters.

At the beginning of play, the two teams time up at their respective goal posts, and the referee places the hall in the center of the field. At the sound of his whistle, the center of the team locking off rides down the field and attempts to boot the hall toward the opposing team's goal. Contact of his foot with the ball, or failure to contact, is the signal for the unleashing

of plenty of action The two gramas of players, with the exception of the goal keepers rash toward the bal, pach man intent on forcing it down to the enemy goal, or preventing its being booted toward his own goa The remarkable case with which he players an avert grashes by born breadth margins, and the quickness with which they maneuver into position for kicking the ball or block ing an opposing kick indicate the high degree of flexability of

the mounts no less than the skill of the players themselves,

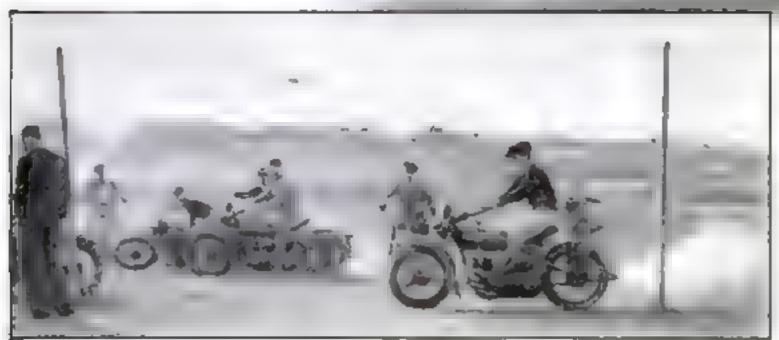
Of course, the mad scramble for the soccer ball results occasionally in a mishap. Two machines may tangle, a rider may execute a tailspin too quickly and find himself and his mount sprawling on the ground, or some one may carelessly break off a goal post (which explains why the posts are no larger than four inches in diameter). Once in a while, a machine must be taken out because of mechanical difficulties. Sometimes, too, the ball is punctured and a new one has to be obtained.

When a ball is played across a boundary line, or when a penalty kick for the goal fasts, an umpire or other official bounces the ball back into the field, and the playing continues. Infraction of rules may cause a team to be penaltied, giving the opponents a chance to kick for the goal from the fifty-foot circle. Major violations may lead [Continued on page 95].

LAYOUT OF REGULATION MOTOR CYCLE POLO PIELD







EXCITING MOMENTS N A NEW SPORT

The is a hotty of the goals. The expense of the goals. The expense of the goals who is a solution of the goals. The control of the goals of the goal

ENTERTAIN YOUR FRIENDS WITH THESE

SPECTACULAR

Chemical Tricks

pictures on this page.

by twisting a cylin-

der of wire gauss around a tandle set

in a cork capping

the cylinder with a

disk of wire, and

edding amali bandle

You can thrust a lighted Davy lamp upword into an inverted bow of oir and gue without fear of an axpine on. The wire been the temperature below the ignition point

By Raymond B. Wailes

LANCING over the rows of botties and flasks in his home laboratory, every amateur chemist
wonders at one time or another
"What shall I do next?" Here are a few
tests, selected at random, that afford interesting diversion when "stock" experi-

ments pall,

How about making and trying out for yourself a model of the device that Sir-Humphry Davy invented for miners, many years ago, which has come to be known as the Davy safety lamp? This important little invention removed the danger of inflammable coal gases being touched off by open-frame lamps carried by the miners. It consisted of an oil lamp with a cylinder of iron wire acreen, about six inches high and an inch and a half in dameter, surrounding the flame. When an explosive air gas mixture passed inside this screen, it would burn freely, but the flame could not pass outside, since dissipation of heat by the wire lowered the temperature below the ignition point. Thus the screen acted as a "flame sieve," without seriously obstructang the light.

You can easily make a model of this lamp. Simply roll a cylinder of wire screen of suitable size into a cylinder, place a cap over it, and thrust a cork in the lower end to carry a small candle of

birthday-cake size. The fineness of the acreen mesh plays an important part. Ordinary window screen, which has fourteen to not teen wires to the lock, is too coarse to be used as a single layer and should be rolled upon itself about three times to reduce the free space between the wires With screen of thirty mesh (thirty wires to the inch) or finer, only a single layer is needed for proper operation. The seam of the cylinder should be soldered or wired to keep it from unrolling, and the metal cap cut to fit, may be soldered or wired on. With the addition of a wire handle, the lamp is complete

Set up the lamp and play a stream of illuminating gas from a rubber tube upon it. The candle flame in the

The model of the lamp grows in size, but the gas outside the lamp does not carch fire

Try filing a wide-mouthed bottle or small

Try filing a wide-mouthed bottle or small bowl with illuminating gas, and inserting the lamp. Since the gas is lighter than sir, fill the container by heading it upside down and letting the gas flow into it from the bottom. When the safety lamp is introduced from below, the tame becomes larger, as in the preceding experiment, but the surrounding gas is not ignited. To show that the mixture of gases around the lamp is explosive, place the bowl on a convenient stand and thrust a long lighted taper up into it. The resulting flush shows what would happen if an exposed flame came in contact with gas in a mine shaft, though in this case the width of the mouth of the bowl avoids setting up a dangerous pressure of explosion proportions. Do not use a match, or you may singe an arm or cost sleeve

If illuminating gas is not available in your home laboratory, you can make a substitute by pouring balf a teaspoonful of gasoline or alcohol into an open bucket and shaking it to mix the vapora with the air. A lighted Davy safety lamp lowered into the bucket will not ignite the explosive air and gasoline-vapor mixture.



So efficient is this preventive of mine explosions that a stream of inflammable gas tan be played upon it with safety

Have you ever tried preparing any of the fascinating, mysterious compounds that glow in the dark? Home chemists are not always successful in making these "phosphora," or phosphorescent substances, but here is a pretty experiment that always works. Strong sulphuric acid is the only chemical you will need.

Fill a test tube with cold water, and immerse the tube in a small quantity of the acid. Remove the test tube and let the excess acid drop off, leaving a trace of it chinging to the outside of the glass. Now hold the tube in the blue flame of a

Bunsen burner

Immediately the ou side of the test tube glows with a purplish light. In a partly darkened room, the effect is striking, A "soft" Bunsen dame should be used-that is, one which receives just enough air to make it blue and no more Do not hold the tube in the flame too long, or it may becak.

It has been suggested that the purple luminescence comes from the oxidation of sulphur in the sulphuric acid, the sulphur being liberated by the reducing action upon sulphuric acid of atomic hydrogen in the burner flame. The water in the tube simply prevents overheating

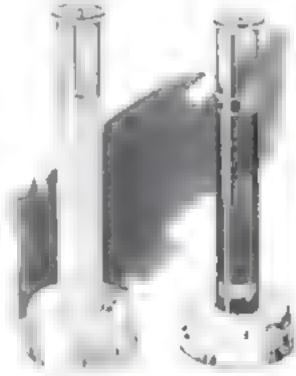
Sometimes a similar luminescence may be observed with phosphoric acid or justphurous acid. If you care to try this out, You can prepare your own sulphurous acid which is the product that you will have after bubbling sulphur dioxide gas

through water

Your Bansen burner may be made to play several color tricks with compounds of sinc. One of these is sinc carbonate, which you can prepare in practically pure form by adding a solution of sodium carbonate to a solution of sinc sulphate or of mac natrate. Filter off the white precipitate and wash it seven or eight times with water while it is still on the filter paper

When this zine carbonate is heated in a crucible or evaporating dah, or on an fron plate, it loses carbon dioxide and

AKING of the Davy miner's lamb is only one of many stunts with flame and color you can perform easily in a home laboratory



M a some handle with water and pour the milky solution into two test tones. And a base to one and an acid to the other. The acid so so tion will settle out, while the other will not



A strange pulple glow results when you perform the test above. Dip a water-filled test tube in nurphuric acid, then heat it

turns into ainc oxide. While it is hot, the color is yellow, but it becomes white again as it cools to room temperature. In fact, this compound is used as a white pigment and is sold under the name of Chinese white

Ame ferricyanide changes color from white, at room temperature, to green when heated. Like the preceding compound, it can be prepared from a solution of ainc susphate or sinc nitrate. And a solution of potassium or sodium ferricyauide, and you will obtain a voluminous precipitate which can be washed by decantation and then filtered, or filtered off first and then washed. Washing the last two precipitates is necessary to remove soluble chemicals that would otherwise contaminate the product

You can perform another inceresting trick with the Bunnen flame by wafting it across the curface of a solution of silver nstrate, which has been placed in a purcelain evaporating dish or crucible. In about five seconds the surface of the inquid becomes a scolared, and you will find it covered with an extremely thin film of metallic silver particles. The liquid itself has turned a grayish green. It contains what are known as "colloidal" particles, which will remain without settling out for a considerable time. Their presence may be shown by letting light fall upon the liquid after passing through a pinhole in a card. The bright beam in the liquid is caused by reflection of light from the

If you wish, you can prepare the silver attrace solution for this experiment by dissolving a small crystal of the solic substance in distilled water. Tap water should not be used, since it contains chlorides that would cause a precipitate of silver chloride. The solution should always be kept in a glass-stoppered bottle. as it is destroyed by contact with a cork

If you obtain some white thing clay which can be purchased under the name of kaolin, and shake a pinch of it with a bottleful of water, you will have a suspension of clay particles that shows a curious (Continued on page 101)

Celluloid Funnel for Pouring Powder

THE FUNNEL shown will belp you pour light, fluffy powders from one carton to another, or to albottles for your shelves of themicals. It is made of cel a ord and is comented with any standard celluloid cement or with a solution of celluloid in accione or amylacetate. Ether thm sheet ce luloid or a thicker ma terial may be used, as I does not matter whether the funnel holds its shape. Its large diameter aids in handling powdery substances. After use, the funnel may be rinsed with water to remove hering particles. Do not, however expose it to warm water for an great length of time, the heat tend to soften the celluloid.

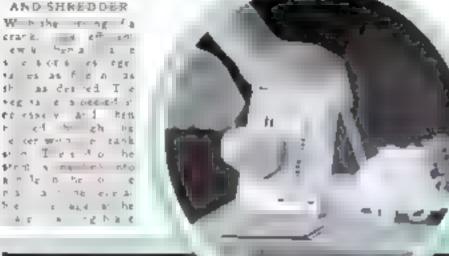


New Devices for



VEGETABLE SLICER AND SHREDDER White mag (a 4 2 F 2 7

a married neo





NOUBLE DOOR PERRIC BATOR The pres a r the part good or the above were a sofor entering degree y agender when et in y Brings on the contact are by ware got the none of a be not the contact of the conta



S PAIGHTENS JAN 1105 F



TOJOSPEAKER T AHON A he big gave more to we ¿ hendeakers e will be a confidence Hale like about to a from highers a un-

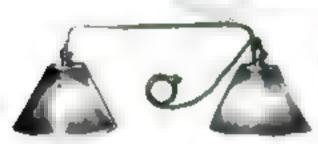
MONOGRAMS 401 gri unit saue ance a con be transfer to the gry article of Lioth or ea her by press of w h a hor if in The blacked imbience withsteads laundering



MAGAZINE RACK IN ARM OF CHAIR By the the a to resta of this orbits sted easy chair are pochars for morgas new of magazines. A cach in he aide releases the panel, allowing the magazine compartment to be opened as shown. The pockets do not detract from the appearance of the chair

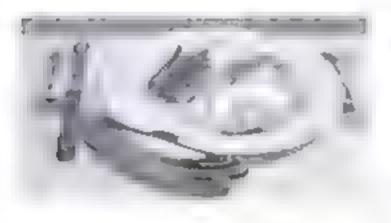
Modern Homes



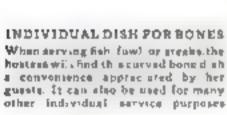


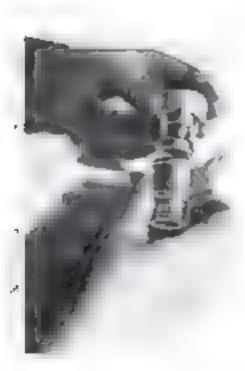
LIGHT FOR GAME TABLE Adequate lighting for games such as table tennis and bill to do a afforded by an outfit which includes two parchagest paper shades complete wire eaterning factor as payed and a factor to the rubber reed being prograd into any contentant crowns outlet. It is a so easely taken down





Capped onto the edge of the ragular dinter plan thin aux tally dish also holds to the crackets, or butter. Be about the captured chapt a nerve valuably table space.





HOSE COUPLING. One sect on of the hose coupling shown at the left is attached to the hose the other stays permanently on the faucet. In come it no the hose the sections are socked together with the eccentric lever



AUTOMATIC DOOR LIGHTS

When a visitor steps on the door mat of his home he umanated house number and two side pane's flash on A button contract a keybole ught

NON STICK COASTERS

Small metal frames sat in the coasters at the left breps them from sticking to the wet bottoms of tumbiers or highball glasses. They also serve as ash receivers

Duestion: Is it true that a wolf's eyes differ from those of a dog?—B. H., Providence, R. I.



A -the publis, or iris openings, of the wolf's eyes are oblique sits. The pupils of the dog's eyes are round, while those of the for and the jackal have vertical pupils. It is this peculiarity that gives the wolf his sinister expression

Not a Close-Up

G. E. B., nocutestes, w y in the field of distance photography, one of the longest shots on record was made by an Army photographer from an airplane at an altitude of 1:.000 feet near Sounces, Calif The camera lens caught the peak of Mt. Shaste, 331 miles away



The Grocer's Friend

Q.—who inventes the paper bag?—5. J., Richmond, Va

A,-A PATENT on the paper bag was usued to a woman, Mus M E. Kuight

The Aristocratic Race Horse

W O. H., GLACIER PARK, MONT. All thoroughbred race horses are descendants of three famous mounts: the Byerly Turk, a charger ridden by a Captum Byerly in King William's wars; the Godosphin "Arabian," thought in have been a Barb, and the Durley Arabian, which was imported into England from Aleppo, Syria. All three of these mounts were male horses. The mares used in the breeding of the famous thoroughbred were nativo English mares, probably descended from the sturdy and fast-running horses that drew the scythe-chanots of the early Britons, as reported in Caesat's "De Bello Guiñco"

The Band in Your Hat

Q.—were notes a man's hat have a little white bow inside at the back of the head-band? It isn't of any use, as far as I can see —K. D., Detroit, Mich.

A.—MEN'S MATE, a few centuries ago, were made of heavy steel. Consequently, for comfort, the weavers placed circular padding in side. This padding was fastened with a bow in the back, so placed in order that it would not press upon the forehead. The little white bow is therefore a relic of frudations. The circular padding is still worn today in the shrapnel betinet of the Army.

Tides and Undertows

G S. S., ATLANTIC CITY, it j. The cause of the undertow in the surf is primarily the sequence of tides and waves. A wave forced up on the beach must recede. As it recedes, a second wave, rushing forward, breaks over it. This action is repeated so often that a constant undeccurrent, receding toward the deep water, is formed.

Too Small To Hold Air

Q.—ir tire moon has enough power to cause occur tides on the Earth, why can't it hold an atmosphere as the Earth does —C. J. Deerwood, Minn.

A-it is the size of the moon that prevents it from holding an asmosphere. Its diameter is but 2,159.6 miles, just one quarter of the earth's diameter. It is described as "a world spouled in the making."



Count 'em Yourself and See

Q -FLUCKING a tarkey for last Sunday's dioner brought this question to my mind Can you tell me how many feathers a turkey has?—Mes. C. M. B., Vancouver, B. C.

A .- On the average, a turkey has 3,860 earliers

Official Sunrise

Q WHAT IS it that determines the contitime of sumse?—E T Floshing, L E A.—THE SANY Department, through its cauteal almanar, gives out the time of sunrise for each day. The moment chosen is that at which the sun's lower rim stands on the true horizon. Because of the diffraction of light rays by the earth's atmosphere, the sun is not seen in such a position at the particular turns designated, although it actually is there,

Bridge of Ice

E. R. R., JERSEY CITY, H. J. Railroads have been run across tee eighteen inches thick. Lake Baikal, in Siberia, has carried the tracks of the Trans-Siberian Railroad during the winter months. Sea Ice, however, is plastic, and will not support much weight unless it is very thick.

A Short Life but a Merry One

Q.—WHAT IN considered to be the "lifetime" of an automobile?—H. F. C., Winnemucca, Nev.

A.—All Autonomia has an average meful period of about seven years.



Fake Jewelry

H L., LAMBERTON, MINN. Stress, a lead glass, is used as the basis of most artificial cems. It looks like the diamond, but will not of course, withstand the diamond tests. Coloring agents are added during manufacture.

Homemade Tooth Paste

A. A. M., WALLA WALLA, WASR. Here is a formula for tooth paste calcium carbonate, levigated, 100 parts, cuttlefish bone, in fine powder, twenty-five parts, old, white, powdered Castile soap, twenty-five parts, tincture of carmine, ammonisted, four parts; simple syrup, twenty-five parts, menthol, two parts, sitohol, five parts, and rose water sufficient to make a paste, which can be put into lubes.

Air and Life

Q-Aut the rare gases such as helium, prgon, seon, krypton, and senon in the air we breathe essential to life?—H. O., Montreal, Que., Canada

A.—xor is the results of recent scientific tests arean anything. Laboratory mice, provided with an atmosphere lacking all of these rare gases, were healthy and lively after forty days.

Noise from the Sky

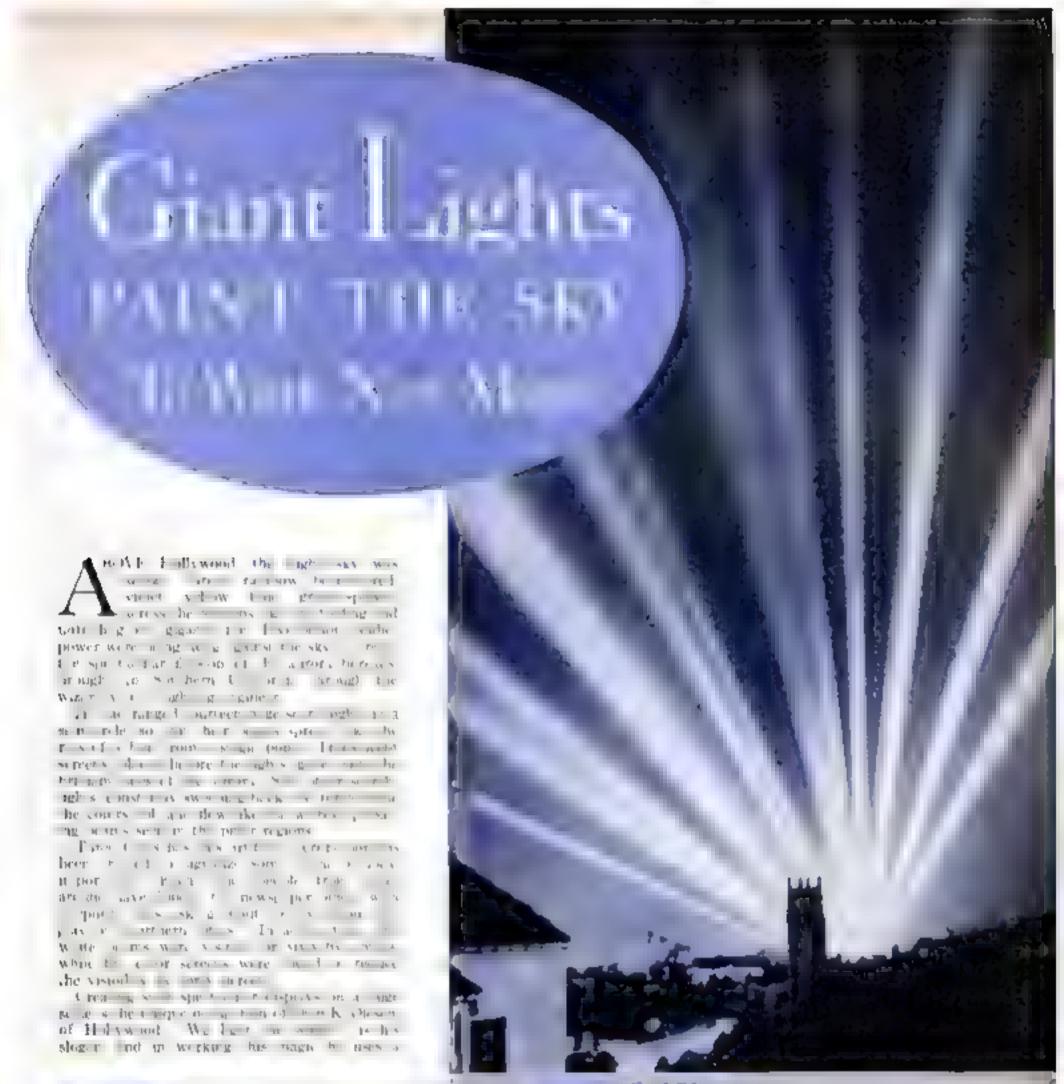
Q-ts take motor or the propeller of an airplane responsible for the larger portion of the noise heard by a person on the ground?—A. N. Newark, N. J.

A.—ANTI-ABSTRAFT listening devices hear first the rhythmic sound of the motor; because this sound pulsates more distinctly, it is the more easily heard, and therefore the louder.

Fish Have Reverse Gear

Q.—case risst swim backwards?—C. S., Keighley, Yorkshire, England.

A-ves, and they often do, but never for more than a short (Continued on page 10.





The northern gits invight to Southern Cal.

Intimated a norway for foreser on proceur Point on manneral ward with the forther or and the first war employed to create this beautiful special of

HOW ILLUM NATING EXPERTS
USE PORTABLE EQUIPMENT
TO CREATE STRIKING AND
BEAUTIFUL NIGHT DISPLAYS

By Sterling Gleason



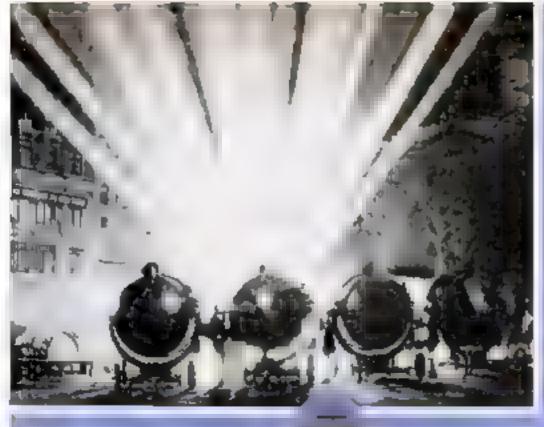
the most speciacular of the displays.

Another outstanding achievement in recent months was bathing the gigantic bulk of Boulder Dam with rambow hues to mark the creation of a bage man-made lake running back 125 miles into the Colorado plateaus. To accomplish this feat, Olesen, the Casifornia expert, thipped a whole carload of equipment from his Hollywood storeronms.

At the dam, a "high-line" acrisl tramway awang a bank of big transformers out over the gigantic structure and set them on place for the huge alternating-current uncandescents. Giant searchlights were hoisted to strategic points, floodlights perched at picked locations, colored gelatin transparencies clamped into place. Half a mile from the dam, a powerful. long-range stereopticon projector was set up with its lens trained on the face of the structure. This machine required an astonishingly beavy supply of direct curcent-enough to run an elevator or heist Olesen powered it by tapping an electric railway and running a line for down the

mountain wall At midnight, all lights were turned out, leaving the canyon in pitch darkness. At the throw of a switch, brilliant rainbow bues bathed the walls of the canyon and lighted up the glast intake towers rising 1 200 feet from the cavernous river bottom. As the ceremony proceeded, gorgeous color combinations played over the massive structure, converting its huge bulk into a fairyland of lights. Finally, as the display reached a climax. Olesen switched on the stereopticon projector. From its tiny slide, only two and one half inches square, leaped. a buge image—an American flag, brilliantly projected upon the concrete face of the dam itself. Thrown 2,000 feet, it was entarged 9,000,000 times.

POPULAR SCIENCE MONTHLY



Mirrors split searchlight beams for anti-sireraft work

One of the fleet of mobile tearchaights operated by Otto K. Olesen, California lighting expert. Towing it is a mammoth power truck

Geometry plus experimentation enabled Olesen to perfect a tanque lighting system for night auto racing at Ascot speedway. Three problems confronted him, to provide enough light without throwing it into drivers' eyes; to avoid troublesome shadows, and to guard against power failure. On this track, the average quantication time is seventy-five miles per hour, and a driver traveling at this speed—110 feet per second—would have no chance at all if the lights should suddenly go out.

TO THE first problem he applied geometrical principles. Placing the lights high in the air shortened the shadows, locating them at the geometrical center of the track, caused their beams to fall so that the shadow is always on the driver's right as he makes his turns to the left

To insure a continuous supply of current, he took the power supply from the lines of two independent companies, each running its own line into the speedway. Lights then were connected alternately to the two sources, so that if one source failed, half the lights still would be burning Meanwhile, the switch would be thrown over instantly to connect all lights with the remaining power source

During the past few years, scientific lighting has become a vital factor in other sports as well as in auto racing. Midnight golf is now possible on one western course and flood aght football, baseball and tenns are becoming common The National League has authorized a certain number of league baseball games to be played at night. Coaches and athletic directors from such widely separated states as Texas Pennsylvania, Wisconsin, Georgia, and Minnesota have reported that night contests are proving more profitable and popular than those beld in the daytime

At Chicago, Ill., and several other American cities, special "light trucks" now aid firemen in battling flames. Equipped with generators spun by gasoline engines, the trucks have swivel searchlights mounted on top. These can be swing in

any direction to play their beams over a blazing structure. Under such conditions, "all fires are fought in the daytime." The brilliant flumination helps officials to judge when walls and timbers will fall, and decreases the danger of firemen stumbling over objects or falling down open shafts.

In other emergencies on land and sea—in floods, earthquakes, hurricanes, shipwrecks, and ocean rescues—the searchaght and the floodaght in the bands of experts play a vital part

During the Long Beach, Calif., earthquake of March, 1933, the borror of darkness added to the terrors of rocking buildings and falling masonry All electric lines were dead. Hospitals still standing had no lights by which to sid the injured

The sheriff's office immediately telephoned Hollywood's lighting expert, Olesen. He rushed a number of power plants to the scene. His men cables into the hospitals and set up flood-lights in the corridors and in surgical operating rooms so that medical work could go on. They



Motion-picture pre merce in Hollywood make work for lighting experts. In this picture a bettery of gime lights as seen in action on a street of the movie city

A single operator works two large acarchights in a big-scale lighting effect. In space of the great size of the lamps, they are so delicately balanced that they are moved easily by hand





I luminated the key points of rescue work

after an earthquake

A year later Olesen again aided victims of a major disaster. A January min storm was battering Los Angeles, when, about mininght near the suburb of Montrose, a wall of water released from a mountain pocket, raced down the mountain side with its road of rocks and mid. smashing through houses and crushing dozens of people in the wreckage

In his Hodywood home Olesen was Latering to a radio program when it was interrupted and a voice and, "If Otto K Olesen hears this will be come to the aid

of Montrose? We need light."

Call of as many of his men as he could reach, he hurried hage searchlights to the scene. Under their brilliant illumination sheriff's deputies combed the runs for survivors of the disaster.

ho large a concentration of light has great military usefulness, and Olesen's equipment forms an official part of the U.S. Naval Reserve head in readmess in case of emergency. For example, if enemy automates should suddenly raid Southern California. Otesen's feet of mobile searchaghts could instantly be set to locate them.

The vital part "searchlight artillery will play in a future war is so well recognized that the U.S. Army has ordered 104 of the most powerful lights in existence Using those already delivered, crack mailary operators are probing the night sky in various parts of the country in practice ant -aircraft maneuvers

Each of the new searchights sends out a binding beam of \$00,000,000 candlepower and is capable of picking up an enemy plane flying at an altitude of three miles. Constructed of aluminum alloy most of the new lights are to be mounted on wheels and towed behind trucks equipped appears us a directed parallel to the ground into a tilted mirror divided into segments. Each segment is set at a different angle so the main shaft of light is split into nine separate high-intensity beams shooting upward into the sky. Special blowers remove the gases and cool the 800,000,000-candlepower searchlight

More than twice as powerful is the Lindbergh Beacon the world's largest searchlight, at Chicago, Ill. Big enough to hold a man, this grant light is supported by a steel-and-aluminum tower designed to withstand a 100-mile-an-hour gale. Its The his as a few or the few of the first that the first that the state of the few of the

A spectacular lighting effect at bleved in New York City, a few years ago, proved too realistic. A midtown skyscraper had just been completed and the owners wanted something to attract attention to the building. With the help of a lighting expert they worked out a spectacular night display jets in the tower of the building sent billions of steam rising into the air while colored lights, projected on the moving vapor, created the illusions of smoke and flame. The first night, sixteen fire alarms were turned in and the next day the Fire Commissioner called to ask that the display be discontinued

These medium-sized spothights use incandescent bulbs like the one the man is holding



New Kinks for Radio Experimenters

Mirror Makes Set Wiring Easier

AN OLD mirror hung at the rear of your work beach will help to simplify your next set-wiring job. With it, the anderside of the chassis will be in full view even when you are working on the top. Wires can be inserted easily through ho as and parts on the underside can be grasped readily incidentally a next test panel can be made up by installing the mirror in a wide frame and then arranging the necessary test maters, plugs, and switches around the sides.—W. W. K.

A Short-Wave Wiring Tip

FOR best results in wiring short-wave receivers, ground all ports of the circuit to a narrow brass strip mounted inside the chassis. This eliminates many of the losses that occur when each part is grounded individually to the chassis

Stand-Off Insulators From Porcelain Tubes

INEXPENSIVE stand-off insulators can be made from the ordinary porcelain tubes used in open house wiring. The large end of the tube is clamped to its support by a small, countersuck block of wood. A short section of wooden dowel then is forced into the tube, secured with sheliac or cement and a suitable screw



Drawing shows how the insulator is assembled.

is driven into its outer end. To avoid splitting the tube, a hole should be drilled in the end of the dowel before driving the screw. Aimost any sort of soldering lug, bioding post or clamp may be fastened to the tube in this manner and wal be insulated from the supporting panet by several inches of porcelam. The resulting insulator will prove efficient.

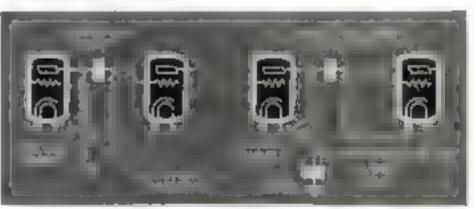
Midget Double-Throw Knife Switch

KNIFE switches are no novelty but a double-pole, double-throw unit no larger than a postage stamp is something out of the ordinary. The one illustrated measures only one by one and one-quarter inch yet it is a perfectly workable duplicate of the larger ones. Its compact size



Tiny knife awards fits in the paim of the head

makes it seeful at a speaker-earphone control inside of a small receiver cabinet as a switching unit for portable tube and receiver testers, and in countless other places where space is at a premium. The diminutive size of the switch can be seen in the photograph above.



Automatic Time Switch Turns Radio On or Off

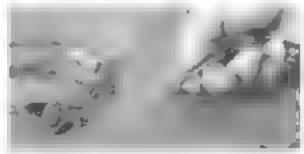
WITH the latest in automatic timers you need never miss your favorite radio program and with a flip of its switch, you can transform your receiver into a new kind of alarm clock. Being small and supplied with a long connecting cord, this new time switch can be placed almost anywhere and a twist of its graduated dial is all that is necessary to put it in operation. It will turn the radio either on or off at any predetermined time tip to ten bours. The photograph above shows the time switch and the connecting cord.

Increases Voltage Gain

BY MAKING use of a simple resistance-coupled amplifier usually can be increased considerably and oscillation completely eliminated. First, replace the usual 250,000-ohm plate coupling resistor with a 500,000-ohm unit. Then, in series with this larger resistor connect a 10,000-ohm unit and by-pass that to ground through a 0.5 mfd. fixed condenser. The condenser provides an easy ground return for the signal and eliminates all oscillation and coupling between stages.—E.B.L.

Long-Nosed Glip Helps In Difficult Test Jobs

PROVIDED with a long, alender anout, the "alligator" clip illustrated, is an improvement over the larger broad-nosed type for test work. Designed for use in hard to-get at places its strong jaws will clamp tightly around even the smallest wire, while its broader cear portion makes it easy to hold. Alligator clips can be obtained plain or with an insulating overshoe.



New "alligator" clip with rubber insulation

THIS INEXPENSIVE Portable



The amplifier in use as a regular public address system. The built-in speaker is behind the grills

ECAUSE it is compact and can he put to a wide variety of uses, the inexpensive portable public-address system illustrated is an deal unit for the radio experimenter. Complete with loudspeaker microphone, and power circuit, it weight less than thirty pounds and can be constructed for less than the cost of a small teceiver.

Wherever a good amplifier is needed, this multi-purpose unit will fill the bill. A series of input binding posts makes it possible to use it with almost any type of phonograph pick-up, microphone, or radio taner. It can be used indoors or outdoors and will feed either the single dynamic speaker housed in its plywood cabinet or a series of speakers mounted at strategic points in a hall or building.

In many public-address systems, the use of various types of phonograph pick-ups often makes it necessary to resort to a complicated input circuit, With this unit

bowever, the four input binding posts solve the problem. A pick-up having an impedance of 200 ohms, for instance, can be connected directly across banding posts 3 and 4 without the need of an additional volume control. Pick-ups of the 500-ohm variety, on the other hand, can be used simply by connecting the two pick-up leads to terminals 2 and 4 and high-impedance pickups and crystal units can be used by making connections to binding posts I and 4

The applications of microphones in public-address work are numerous. By proper connection to these same four binding posts almost any type of microphone now available can be used to feed this de luxe unet. Double-button microphone connections are made easily by wiring the three microphone leads to the binding posts 2, 3, and 4, bearing in mind that the battery for the microphone current must be connected in series with the lead to binding post 3 and that the connection at the binding post should be grounded Single-button microphone connections are made simply by connecting the two microphone leads to binding posts J and 4. placing the battery in series with the lead attached to terminal 4. Velocity, ribbon, and dynamic microphones must, as usual, be used with pre-amplifiers having a 500-ohm or

200-nbm line-coupling transformer, which can be connected directly to binding posts 2 and 4 for 500 ohms and 3 and 4 for

200 ohms

Often it is destrable to use a standard radio tuner in conjunction with a publicaddress system. To couple any type of radio tuner to this amplifier, simply connect. the plate lead of the detector tube through a resistance and a .Ot infd. mica coupling condenser. The connections leading from the plate c roust of the tuner are made at the binding posts 1 and 4, the piate lead being attached to binding post 1 and the B lead being connected to binding post 4.

PLATE and filament supplies can be taken from this multi-purpose circuit simply by changing the four-prong socket. at the rear of the chassis to a seven-prong unit and making the proper B-voltage and filament connections to the socket

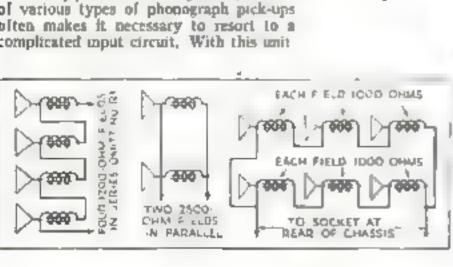
Multiple-speaker installations also are very often required in public-address systerns, especially in hospitals, department stores, and market places, where a large area is to be covered by the amplified sound. How multiple-speaker systems can be used is clearly shown in the diagrams.

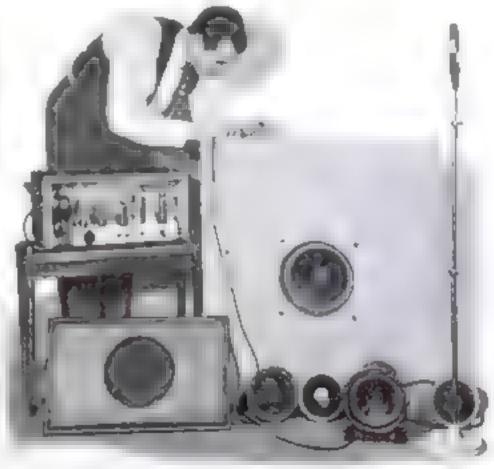
In the building of this ampuner, it is important that the diagrams and specifications be followed closely, especially the laynot of the transformers and tubes. These have been carefully placed to mintmust all possible stray magnetic fields and el nunate unwanted input hum. A great deal of thought also has been given to the proper selection of tubes for efficiency, quality, and distortionless operation

All parts required for the construction are simple, inexpensive, and easily obtained. There are but four transformers and one B-filter choke needed. For best results, it is advisable to use a highquality input transformer to avoid the loss of high-frequency response. The second transformer, a class "A-prime" input pushpull unit, should be of the type designed for use with a type '42 tube, triode connected. If you have difficulty in obtaining

MORE SPEAKERS

Additional speakers may be used. of the one in the cabinet is autsufficunt. They are connected as shown at the right, through a speaker plug 41 the aids of the chasing D agram becom above the speaker hook ups





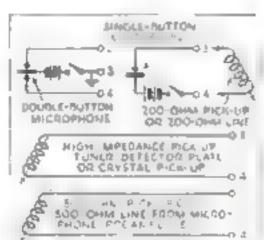
Public-Address System

a transformer designed for triode '42's, a class "B" roput push-pull unit can be substituted.

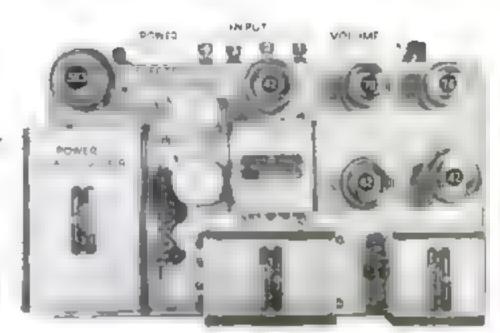
A high-quality push-pull output transformer also must be used if satisfactory results are to be expected. The transformer used on the original has several taps for a variety of speaker combinations to be used with multiple speaker systems. The windings are for 4-, 8-, and 15-ohm voice rolls. It also has a 500-ohm

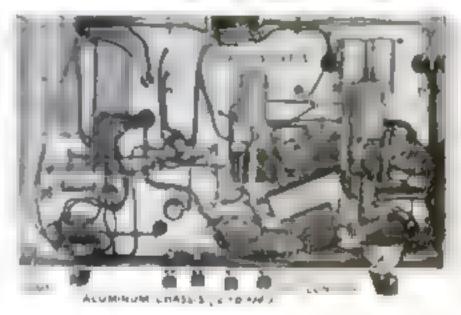
output line for recording purposes and maliple-speaker systems employing a 500-ohm but transformer to the voice coil.

In cases where only a single speaker is used, the output transformer already mounted on the speaker frame can serve. If this transBy
Walter
J.
Bronson









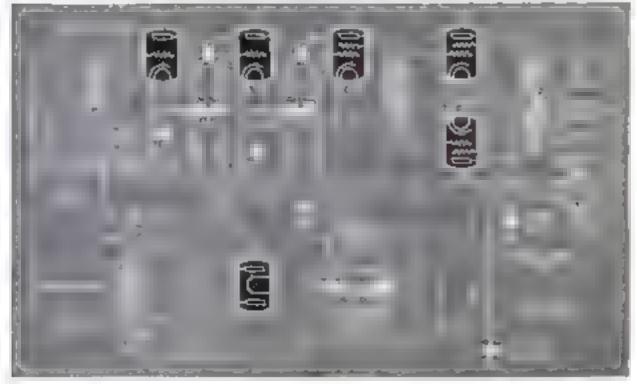
Top and bottom views of the chass a removed from the cabinet. In the latter, setted to and condensers are shown. Note imput binding passes

Photo and diagram as left show how phonoeraph pick upsican be connected into the amconnected into the amconnected into the amconnected author in seen, ad outing the solume control know

former is for a push-pull triode, the connections are made according to the solul lines shown in the schematic diagram. On the other hand, if the output transformer is for pentode output tubes, the connections are made where the dotted lines are shown.

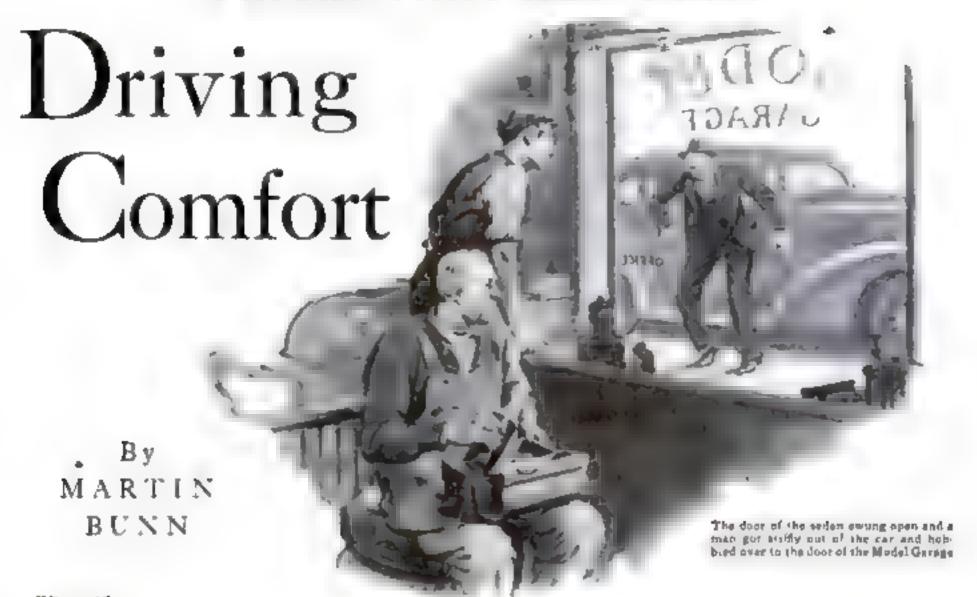
The power transformer should have a current-carrying capacity of 150 milliamperes with good regulation, as the tubes and breeder resistor in the circuit draw 170 milliumperes. If the firament supply is to serve the additional tubes in a broadcast or short-wave tuner, the 6,3-volt filament winding should be heavy enough to casty at least time or ten tubes. On the power transformer used in this original and a 25-volt filament winding, having a current-carrying capacity of fourteen amperes, also is included to take care of tuners having 2.5 volt filament supplies, The rectifier filament winding is for five volts with a current rating of three amperes,

As indicated, capacity input is used in the power-filter network to insure good voltage regulation. The three 8-mid electrolytic condensers are mure than sofficient for excellent filtering throughout the B circuit. Since but one filter choice is used however, it should be a high-grade unit rated at ten bearies inductance or more and be capable (Continued on page 106)



Schemetic diagram with specifications for ports. Filament wiring is indicated by the references "X"

TRICKS THAT ADD TO ...



HERE'S a fellow who's been praces and done things," observed Joe Clark to his pariser, Gus Wilson, as he watched a dusty, mud-spattered sedan pull up in front of the Model Garage.

Gan stuffed the last of a barn sandwich into his mouth and fished a vacuum bottle of coffee out of his lunch hit as he strolled over to the window.

That baby's been traveling off the main routes a long way from here," he said, as he eyed the sedan. "There's no mud just that color anywhere around these parts. And look how it's caked into the spokes. Well, I'll be juggered! If it isn't O'Hara with a new car! "So it is," echoed Joe, as the door of the ander switch over and a red-heared.

"So it is," echoed Joe, as the door of the aedan swung open and a red-beaded man got at fly out of the car and hobbled over to the door of the little office of the Model Garage

"A bit cramped after a long trip. Mr O Hara?" Gus inquired.

I'll say I am," granted O Hara. "Let me sit down and rest a minute."

Gus pushed forward a chair and the red-headed motorist sank into it with a grateful sigh. "What I can't understand," he observed after a moment, "is why this hard chair seems so comfortable. I almost hate to think of getting back in the tar. It cramps me just as bad as any of the old ones. I've been on the road all day and I still have one more tall to make."

"Driving that new car nught to be like sitting on a sofa," said Gus. "Maybe one of the sea - austron springs has come loose or the padding has shifted.

No it's not that Everything is fine and comfortable when I start out but I'm always all cramped and tired by the time I get to the end of a long run. And it's not that the draving position is uncomfortable. That's fine, too. Every car I've had, it's been the same way. Other fellows don't seem to get so fired. Maybe it's just that I'm getting old and can't take it any more!"

"Old!" exclaimed the veteran auto mechanic. "Wait till you're my age, young fellow, before you talk that way. Of course, some people tire more easily than others without counting age at ail. And what tires one man may not tire another But your trouble, I'll bet five gallons of gas, is that you really don't know how to drive a car"

"Quit your kidding," sported O'Hara.
"I'm on the road all the time, and I've driven at least a couple of hundred thousand miles."

"Sure you have," Gus agreed, "but you ought to be able to drive without getting tired. Learning how to do any job means learning how to do it easily. It's the easy part you haven't got the bang of 'yet."

"You mean I put too much beef into

GUS says:

Four wheel brakes will stop a car quicker than the old two wheel style, but they aren't so sale if you don't keep them in condition so that all four are on the job. Let them go, and some day when you're depending on them for a quick stop, there'll be a gosh-awful crash that will make brake repair cost look like buying a newspaper

moving the gear shift—things like that?"

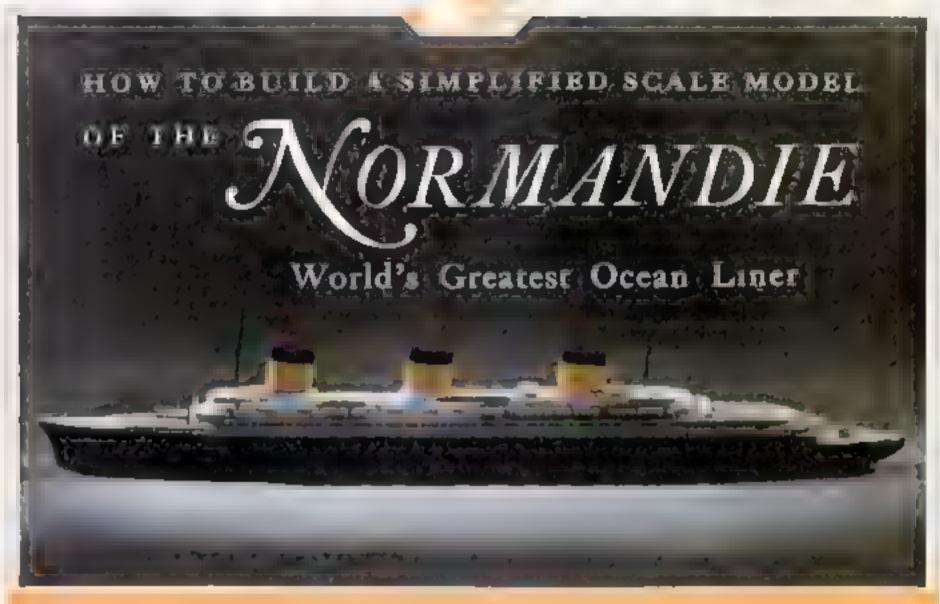
Not a bit of it," said Gus. "You knew all that stuff a hundred thousand miles ago. But, in your driving position really comfortable? You say it is, but are you sure? Have you tried moving the seat back and forth to different distances from the pedals? I'll bet you've done what most drivers do. You adjusted the seat, when you first got the new bus, so that you could reach the pedals without having to stretch. You never thought that the position that seems most comfortable when you just climb in and try it for a second or two, may not be right for long true.

Another thing," Gus continued. "Are you sure that the seal itself fits you? You wouldn't expect every ready-made suit you tried on to fit you exactly right. Why should a ready-made car seat fit you unless you happen to be exactly average in measurements? Perhaps the back seat cushion is not at the best angle to support your back. Possibly the seat-cushion springs are too stiff or too weak for your weight.

If once knew a tire salesman who spent most of his waking hours pounding the road in a car. He was a skinny wiry little chap, the kind you'd think would want all the upholstery he could get to take the pance of the natural padding he didn't have. And yet, the first thing he did when he got a new car was to rip out the driver's seat-cushion and put in a thin, springless, leather cushion. He claimed that bouncing around on top of a bunch of springs tired him more than riding on the hard seat."

I d prefer springs," O'Hara commented.
'So do I, Continued in page 100)

THE HOME WORKSHOP



You say judge from the photograph how recentle our new model of the Normandie in. The over all length of the model is 20th in

Branch at the training of the land are the l

The property of the property o

Transmanage brief.

The property by the proper



The second of th

I I s to we have the complaint as shaping

All the parts can on the period of the parts can on the parts of the p

and of the article. It is advisable to cut and shape the larger pieces, and make up the smaller ones from the remaining scraps. Also, before cutting down to exact length a piece having an end that is shaped or curved, it is better to shape the end, and then measure and cut to length. The hull proper (parts A, B, C, D) may be carved from a single solid block, if preferred.

Aside from the funnels and other fittings, the model is divided into two parts, the hull and the superstructure, which are to be completed separately and glued together after pointing. The bull in turn is divided into the four "black" decks, A, B, C, and D, and one "white" deck E. While the first four may therefore be fastened together with glue before shaping the hull piece E should be fastened to D with light nails. After the bull is completely abaped, piece E must be removed to be painted white on the euges and buff on top at each end

Before shaping the hall, draw the conlour lines shown in Fig. 2 on piece E at the bow and piece B at the stern. On the anderside of piece A, trace the contour bites at the water line, as shown in the diagram on the same plate. Cut away the excess wood to these lines, preserving, however, the shape both at water line and deck as first drawn. The slaping sides of the hull fore and aft will result. Now shape the flare tarward, using the crosssection chagram as a guide. The curved how will automatically result, and it can be trimmed to the exact profile. Trace also on E the exact location of the forward edge of the breakwater (M). From this line forward, whitle down the sides of the deck towards the edges until the whaleback, clearly shown in the crosssection diagram, is formed. With a small chisel, cut out the anchor housings. Piece E may now be removed from the others and net aside while the rest of the hull is completed.

Shape F, G, and H, and fasten to B in

the pocket already formed at the stern. With sandpaper, bevel the edge at the very stern, so that the top of H is shaped as shown by the dotted line in the detail of that part. Shape I and I, and fasten in place. Fit four small pieces of half-split reed around the edges of I to make the swimming pool.

Cut out K, L, and M, and fasten to piece E. Sandpaper

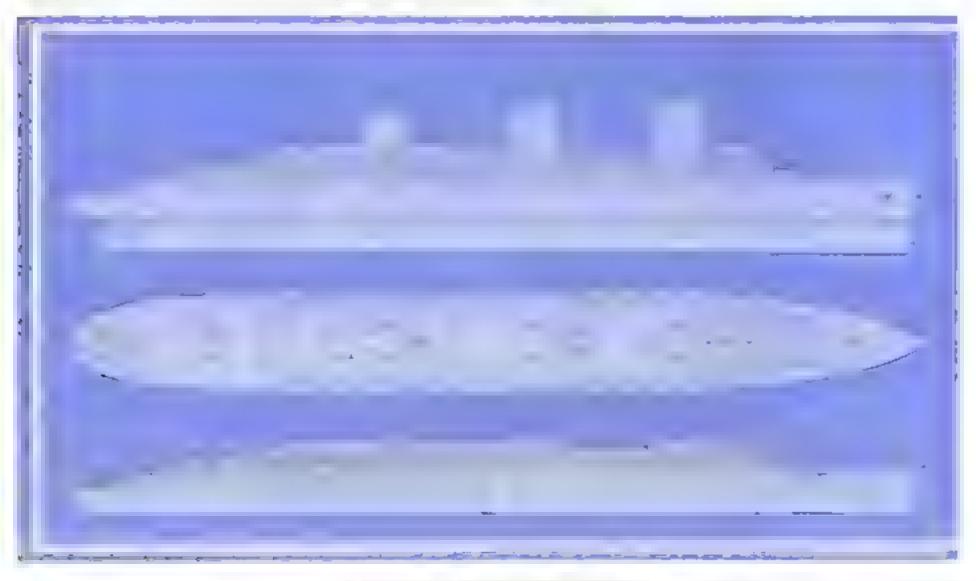
Cut out K, L, and M, and fasten to piece E Sandpaper the joint of L and E so that the deck is smooth Sandpaper the legs of M until they gradually slope into the line of the deck. Make the two derricks from 1 10-in, round wood and insert into E after drilling hoies in the proper locations.

Cut three anchors out of thin card and fasten two at the sides and one across the bow,

A better appearance may result in the model however, if the bow anchor is umsted, since it is deficult to fasien it pearly on so small a surface.

To proceed with the construction of the superstructure, shape all the pieces shown in Fig. 3. You will notice that many are identical and con be cut and shaped at the same time. Also, N and P are alike, except that in fastening them to O. the rounded edge of N is fore, and that of P is aft, while P is uppermost. After P in fastened to O, small holes should be drilled into P directly over the projections of O, as shown.







The detail photograph at the left shows the forward part of the superstructure the foremast, and the forward funnel. Note the arrangement of the Lifeboats. To samplify painting problems and insure a clean-cut job, he I must and superstructure are painted separately before nesembling the model



Fasten R to N and S to R. Since R has a slightly shorter radius, the edges of N and S will extend beyond R. In the lattle groove thus formed, insert short 3/16-in pieces of split bamboo to give the effect of large windows, Fasten Q to the underside of P.

The next few steps are the ones requiring the greatest care. Glue U' and T' to P. Across these two pieces, glue the lifteen paper strips shown by dotted lines in the pians; they are to hold the lifeboats. Fasten U' and T' to U' and T', and be certain that the paper strips remain in position until the glue hardens. Cut thin wire into pieces about 14 in, long, Into each of the holes drilled in P. lasert one of these short wires. Carefully bend the wires until they touch the edge of T' and U'. Bend down the remainder of each wire until it is flat against the top of these pieces. Figure 5 illustrates this

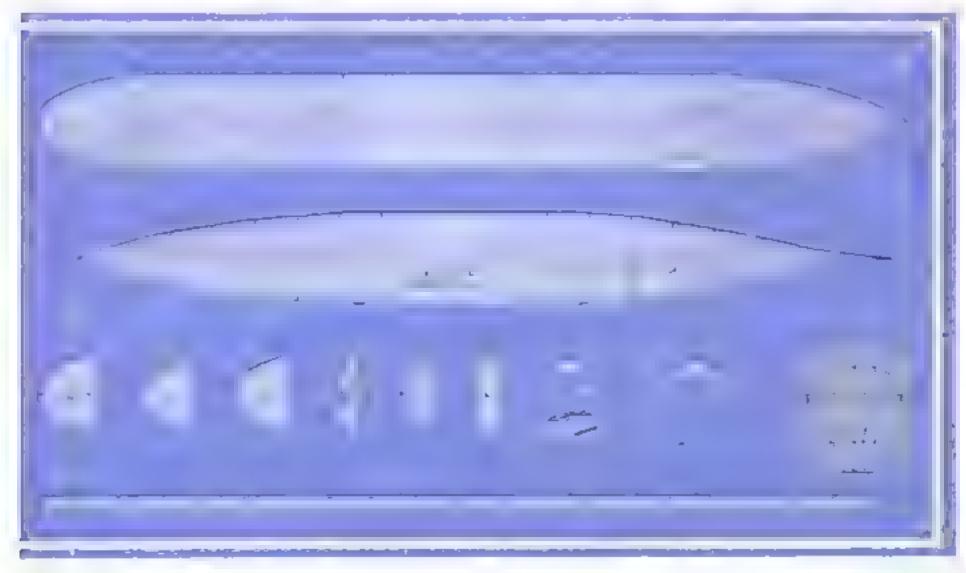
clearly. Now fasten T^* and U^* to T^* and U^* , using plenty of glue and thin beads, so that the ends of the wires are tightly held in place

Give V, W, X, and Y in place, V and W join directly over the juncture of T and U.

Cut to shape the seven top-deck housings shown in Fig. 4. Note that piece FB' fits snugly into Z; also that FD fits soughy around the end of V. Fasten all to the superstructure as indicated in the

side elevation and plan on opposite page.

Make the two streambord ventiators and the lifeboats as shown in Fig. 5. There are three sizes of lifeboats, twenty-six being ½ in long, two, ½ in long and two, which are actually motor launches, ¾ in long. The twenty-six that are all alike can best be made by rounding the edges of the 5/32 by ¾ in, stick to the shape indicated, and then cutting or sawing crosswise, as if slicing bread, at ½-in, intervals. This stick can (Continued on page 76)

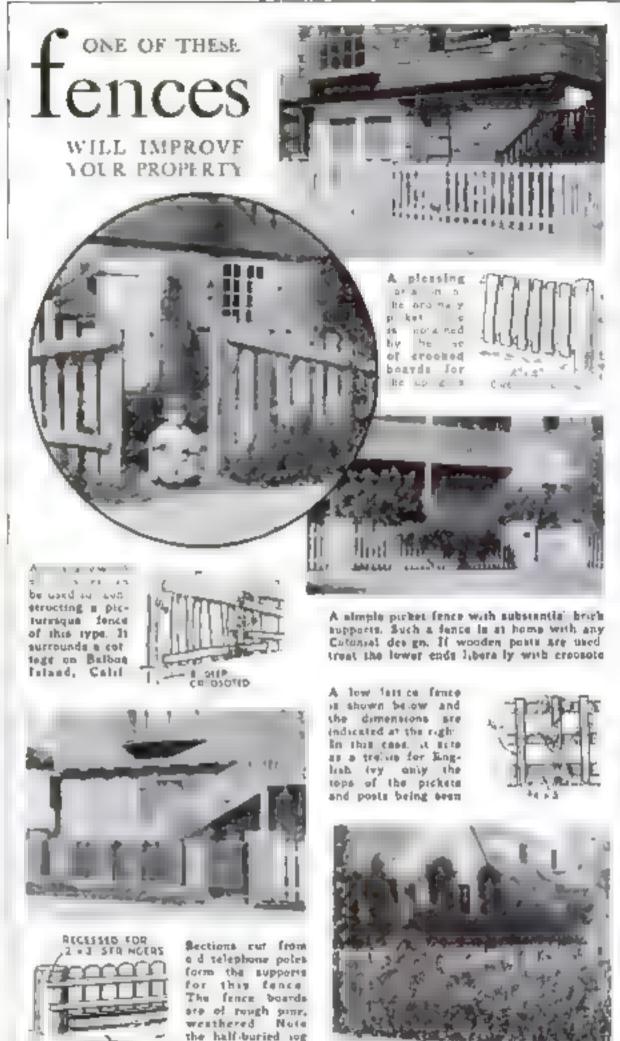




TURNED ORNAMENTS FOR BOTTLE STOPPERS

ATTRACTIVE and ornamental bottle stoppers such as those illustrated above can be easily turned on the lathe and then attached with waterproof casein give to size No. 7 or No. 8 corks.

The clown figure was first turned to shape; then the wavy collar was formed by means of a hand granding tool, as shown in one of the photographs. The realistic fly at the top of the column is a small wood turning, with reliuloid wings bead eyes, and wire legs added. The life-saver's ring was turned separately from the base and the two then glued together. All sorts of amusing names can be lettered on such rings, if desired Use quick-drying enamel, rather than lacquer, for finishing and ornamenting





Using a portable electric drill to bore down holes. The sliding table is designed for stock of in, thick, anything thinner must be blocked up

SLIDING DOWEL-HOLE JIG

ALTHOUGH easily constructed, this jug and sliding table for a portable electric drill proves a great timesaver over usual methods of doweling. Accuracy is insured by centering the marked stock in relation to the table.

The fixed part of the device consists of a solid platform 9%-in, wide with grooved edges. The drill is held in place on the platform by a backpiece fitted to the handle and a split yoke for the drill body. The sliding rails are made from two 4-in, pieces tongued on one edge and fitted in the grooves of the solid platform. A 3-in, crosspiece holds the rails in place. The work-holding table is 10 by 20 in and has a 2-in, piece fastened to the front edge. This table is mounted on the sliding rails.—M. J. McConnell.

POCKET CHART

AIDS IN LOCAL

Weather Forecasting



By EDWIN M. LOVE

ACATION time is at hand. The weather is fairly settled, yet it may act up unexpectedly and make us change our plans. Shall we sleep in the open on our trip, or shall we patronize an automobile comp or a hotel? Which will offer the fairest slies, the beach or the mountains?

While all sections of the United States are now reached daily by broadcasts of weather information, there is a good deaf of satisfaction in reading the face of the sky for yourself, and predicting local weather conditions several bours in advance. If you have a barometer, you can become a skillful prophet by observing that instrument and the wind direction and by jotting down daily notes on your conclusions. Once in a while you may even make a more accurate forecast than the professionals.

Foul-weather signs naturally result from the build of the storm. When brisk south-easterly winds set in and clouds darken the sky, it is natural to suppose that the threatening storm blew up from the south-east, but this is not the case. It came from the west or porthwest, and its center will pass near or north of you, with the wind shifting to northwest by way of south and southwest. If you had noticed at the beginning of the breeze, that the barometer was falling, you could safely have predicted rain within from twelve to twenty-four hours.

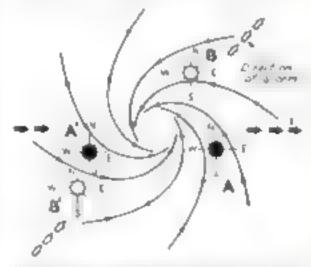
If the wind sets in east to northeast, the storm is coming from the south or southwest, and its center will pass near or to the south, with the wind shifting to northwest by way of north. The rapidity of the storm's approach and its intensity can be judged by the rate and the amount of fall in the barometer

To visualize the make-up of a storm area —cyclone, weather men call it—suppose that a large airplane propeller mounted horizontally on a roding carriage is whith-

ing counter clockwise. There is an upward movement of air, and if you should walk around the propeller carrying a vane, you would find that the surrounding air spiraled in toward the center, the direction of the "unid" depending entirely on where you are with relation to the propeller. If the latter were moved from west to east, or from southwest to northeast, while you stood still, the direction of the wind would shift as it does when a storm goes by

A storm is roughly circular in shape, with a warm, light, moisture-laden core of air rising at the center, and the wind sweeping in spirally from all sides. As the core rises to the thinner upper air it expands, expanding, it cools, just as air from

a leaking automobile tire valve rushes out in a cold jet. Before long, the temperature is so low that moisture condenses on the floating dust particles, and clouds are seen. Presently, further expansion loads



As this storm cames from the west, an observer as A hade the becomeser falling and the wind blowing from the southeast. As its quiter purses north of him the wind veers to south, southwest and west has by seiting in from the northwest as at A'. Compare the observations at B and B'.

the damp particles so heavily with water that the upward draft can no longer support them, and they fall as run. The whole storm system moves across the country at a speed in summer of about 25 M.P.H., and in winter, 35.

The cool, expanded air, unable to riso higher, and freed of its moisture, is thrust aside by the warmer rising core air and circulates to other localities beyond the storm, where it settles to earth again. This is the reverse of the movement in the storm area, and the winds blow outward from these downward columns in a spiral of clockwise motion. This reverse system, the anticyclone, follows the cyclone, sometimes closely, sometimes at quite a distance.

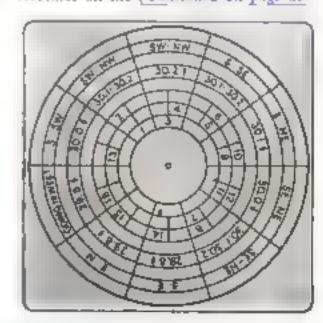
This explains why air pressure lowers as a storm approaches, and rises again as foul weather recedes and the anticyclone comes along.

The accompanying diagram shows a cyclonic area. Note that an observer at B, finding the direction of the wind to be from the northeast, can expect the atorm from the southwest, with the wind swinging to north and northwest as the center of the storm passes to the south.

The United States Weather Bureau has worked out some forecasting rules that apply in general to this country, and these are conveniently grouped in the chart on page 85. The assembling of this chart is a simple task that can be done in a few moments of time, and the resulting pocket weather clock is very handy for local forecasting.

Lay out the two dials and paste them on cardboard, trimming the mount to shape when dry. With a sharp-pointed knife, cut out the windows in the front disk, push a pin through the centers for a pivot, and solder behind to a thin metal button. An eyelet or tubular rivet would make a more durable hearing. Paste the forecasts on the (Continued on page 85)





The two disks can be any convenient size. The author made the outer circle 4 in. in diameter. The key numbers I to 16 on the three inner circles reler to the forecasts listed on page 85.

Garden Pool Made Cheaply from Old Tank

A DISCARDED tank that was rusting away in a junk yard was rectained to make this attractive garden plunge. It was far less expensive than constructing a concrete one, as it cost but \$7 and was transported on the rear bumper of a car

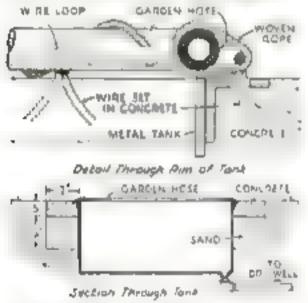
There are all sorts of shapes and sizes of tanks obtainable. The shallow rectangular tank used for mixing mortar is an ideal size for a child's wading pool. There are also round tanks once used as stills, and square or long rectangular storage tanks from the others of tora-

down buillings.

If a tank is too deep, the bottom may be filled with sand. This would make it adaptable for an outdoor aquarities as

well as for aquatic plants.

For our purpose a round tank was selected, 5 ft. in diameter and 27 in, deep It had two holes in the side, but these were welded shut at the junk yard. Most of these dealers have welding outfits. The bottom of the tank had a hole threaded for a 2½-in, pipe, so this determined the size of the drain pipe. The open top of the tank had an angle iron ring with fortyeight ½-in, holes. These holes served a useful purpose for looping reenforcing wire through and for supporting a handrail, as shown in the drawing below



Huw the tank is out in place and method of fastening a garden hose around the metal rim

A 54-in, green-colored carden hose, coupled end to end became the grab rail. It was attached by weaving 34-in, rope around the hose and through the wire loops just mentioned. This raised the rubber hose 34-in, above the ring of the tank so that surface film could wash under it and over the surrounding cement walk to the lawn.

The bottom of the tank excavation was leveled with sand, and after the pulsule of the steel tank had been painted with black asphaltum paint, if

was rolled on its side to the spot and then slid into the hole. Previously, however, the drain nipple and elbow were screwed in place and aimed at a trench leading to a dry well. The later was merely a deep hole filled with stones; it was dug about 10 ft. away. After the tank was in place, a length of 23%-in, pipe was screwed into the elbow connecting the pool and the dry well.

After experimenting with various types of drain stoppers, we found that a gum rubber handboll was most satisfactory. To deam the tank, the ball is forced aside with a stick, whereupon it comes to the

rurfaci

The tank was leveled by filling it with water to the rim. An automobile jack was then used to raise it while earth was rammed underneath. The earth was soaked thoroughly with water so that the tank became well imbedded. After this, a 12-in wide trench was dug all around the tank and 12 in, of sand filled in. This was topped off with 5 in, of stone concrete, puddled with a stick to make it flush with, and sloping slightly away from, the metal rim. The outer edge of the concrete was beld in place by packing the natural wet clay against a board 5 in.



This decorative pool is 5 ft. in diameter and 37 in. deep. A child can swim a sittle in it, and an adult can do a track "dive" into it

high and 12 in, long, the later being shifted progressively around the edge as soon as the clay had been well banked against if

The inside of the tank was pointed an agure blue. This serves the double purpose of presenting a smooth, washable surface from which to clean the inevitable algae and of giving a very clean-looking

blue-green color to the water.

The pool is filted by a 35-in garden hose in one hour and drained in ten mirutes. It has been used by adults as well as children. Amusing us this may seem, it is just large enough for our newly devised adult "dive" in only 300 gal, of water. This is how it in done: Standing with feet at the edge and arching he body over, one grasps the roped edge of the pool about 4 ft. away and just falls sidewise, striking the water with the side of the arched body. This gives a complete and fairly exciting plunge. Another method of diving is to kneel on the edge and go in head first, there being sufficient depth to prevent one a striking the bottom. One may not float with knees bent alightly. The pool is just large enough to enable a child to swim about in a circle.—EDWIN A. KOCH



To carry a 14 ft kayak from our house to a lake two blocks away I use a small truck made as shown. It is merely an open box 11 by 11 by 18 m. mounted on the rear axle and two 10-in, wheels from an old verocipede. Handholes are cut in the ends of the box, and two trunk straps are fastened with screws across the top of the narrow ends. A cushion is placed on the box, and the kayak pet.

on top of it and strapped down.

The axle is run through holes in the box in such a way that it can easily be removed. After the kayak has been launched, the wheels and axle are taken off and placed inside the box, which in turn is set in the cockpit, where is serves as a back rest for the bow paddler, as well as a receptacle for fish.—E, B. Fox.

MINIATURE MERRY-GO-ROUND MOUNTED ON AUTO AXLE

Titts small merry-go-round gives children no end of fun, yet is perfectly safe. The revolving platform is incunted on an old model-T Ford front axie and wheel assembly. The axie is



sawed in half and set in concrete in the ground. Two pieces of 2 by 2 m lumber are bolted to the wheel. The piatform is then nailed to these crosspieces and sawed to a circular shape. One or more seats may be added for very small children, and a pipe handrall effected as shown for the use of older ones, —John Maher

Skipper Sam'l

A QUAINT WOODEN FIGURE ANYONE CAN WHITTLE

> Simple Step-by-Step Instructions By E. J. TANGERMAN

> > Harn to China. You can bet that one of the gnarled bands thrust deep into the pockhis weather-beaten old pea-jacket is fondling has jackknife, universal tool of spilormen. So it's only right that he be immortalized in wood with his own favored tool—the knife.

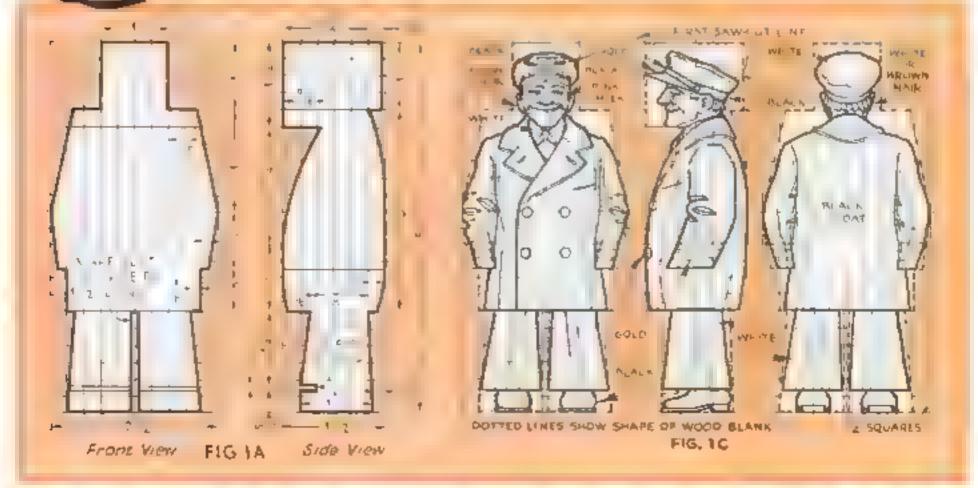
This gental old salt was originally white the doubly a French-Canadian craftsman to whom all credit is due for the novelty of the design. For the figure you require a bit of straight-grained softwood (white pine or basswood) 1½ by 2½ by 5, m a sharp knife and a lattle patience. You don't need any special skill or previous experience in carving

birst, lay out 1/4-in, squares on the front and right-hand side of the block. On this checkerboard lay out the front and side outlines of Fig 1A. Now saw in all the horizontal lines from the sides—tops of shoulders, bot-

ml, white-harry be start to has been appeared by the wind of the one of the read of the read of the pock.

toms of cutts, bottom of coat From front and back, saw in under the skipper's chin and at the back of his neck, at the front and back of his coat, and the slot that divides his shoes from his trousers, which goes in ½ in deep from the front face of the block. Next saw the ¾-in, slot between his legs to the bottom of his coat. Shave off 1 16 in, at the back of his bead, round up his back and the tail of his coat, and saw off ¼ in, of wood back of his pants.

The cuts you've made so far haven't destroyed any outlines of the biank, but from now on, every cut will remove part of the pattern. Saw away the waste wood at the sides of the head and (Continued on page 90)

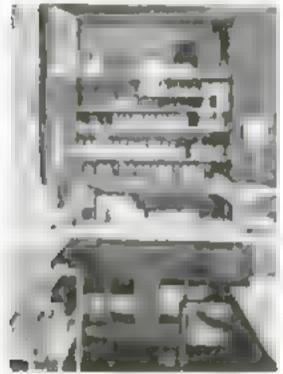


How to lay out the blocks, and three views of the finished figure, all exactly half size. Skipper Sam'l himself is shown in the photograph above

Home Shop Planned for Easy Moving

THE bome workshop shown in the accompanying illustrations has been added to our series of well-planned layouts because of its compactness and the fact that it has been especially designed for ease in shipping. It has been set up in San Antonio, Texas, Detcoit, Mich.; New Orleans, La.; Ann Arbor, Mich., and Oakmont, Pa.

Homer O Williams, Jr., a 20year-old student, is the owner of the shop. He has spent ax years in assembling he toors and equipmen, which are used mainly for toys and model work. The main workbench tool cabinet, and other shop furniture have been made as light as possible without sacrificing the strength required to stand up under ordinary work and also to resist the stress and strains of shipment



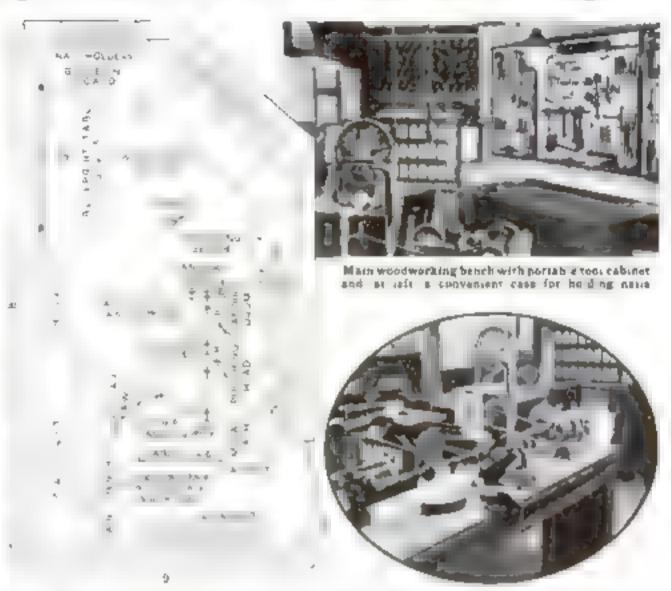
Cabinet for points finishes, and chemicals. The working top siddes back when not a use

A WARDROBE HANGER FOR SUMMER COTTAGE



Wooden curtain pole fastened in a corner of a cottage room to hold clothes hangers

LACK of sufficient closet space in the summer coltage or cabin can be relieved by using a simple wardrobe banger as shown above. It may be attached in any corner, where it takes up a minimum amount of room and it sturdy and serviceable. As indicated in the drawing, one end of a 3-ft, curtain pole is fastened with a regulation bracket to one aide of the corner, and the other end is supported by an ordinary shelf bracket, attached to the other wall.—E. V. B



Layout showing compactores of shop and, in oval, how woodwarking machines are set up

MODERN SHELVES OF GLASS AND COPPER

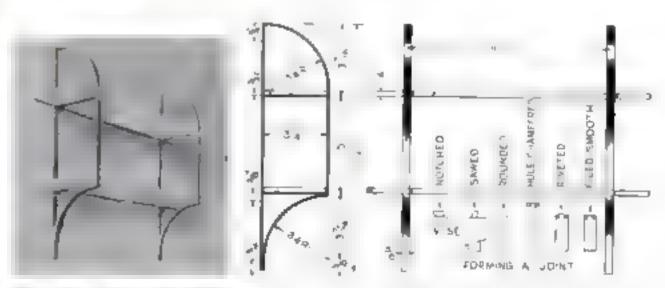
SMALL thodern-looking shelves of copper and plate glass may be made as shown below. The metal parts are 3, 32 by 36 in copper bus-bar strip. Two pieces 29 in long, two 356 in., and two 3½ in, are required together with two pieces of plate glass 3% by 14½ in., four rivets, and four No. 6 roundhead wood screws

The piece may be made proportionately larger if wider strip is used. Should metal in har form not be obtainable strips from 1/2 to 3/2 in, wide may be cut from sheet metal 1/16 to 1/2 in, thick. Copper, brass, aluminum, and monel metal are suitable.

The metal is best shaped by using a fullsize drawing as a pattern. The curves are bent over a rounded surface either by hand or with a soft mailet. The ends of the shelf-support strips may be bent and riveted, but riveting the strip itself, as shown, is nester and takes no longer. Note that the outer end of the lower supports and also the lower end of the brackets are civeted in the usual way. Heavy copper wire will do for the rivets.

File the rivet beads flush with the surface, file the edges where they are defaced from riveting test the frame for squareness, and drill 9 64- or 5 32-in, holes for mounting. Next smooth with fine emery cloth, and if a full pointh is preferred, finish on a buffing wheel. Clean thoroughly and apply a thin coat of clear facquer

Plate glass about 1/2 in, thick is used for the shelves. Old automobile windshields are a good source. All edges should be ground smooth. In the home shop this may be done by running a fine emery wheel at a rather slow speed and having it dip in water.—RALPH L. AUNAL



Decorative miniature abelies of plate glass supported by brackets made from cupper hus-bar strips

KNOT-WORK

Slippers

for Summer Lounging. for Beach Wear for Bathing

Fig. 1. The solen are marked on a spangerubber chair or knee pad and cut out with large shears. At right; Completed alippers

HE wearing of these novelty bath shippers, or mules, gives an impression of walking on thick, luxurious rups such as no cord bathroom floor has ever boasted. A pair can easily be made by tying square knots in cords attached to a pair of soies cut from a sponge-rubber pad. They can be changed from mules to soft, spongy beach shoes merely by carrying the knotled cords farther to the rear around the beel. For ordinary authors wear, the cords may be knotted to thin leather soles, to which you can attach ten-cent rubber half soles and heels, obtainable in any department store-

To make a pair of bath slippers ake those shown in the eval above get a 25 cent sponge-rubbee chair or knee pad, such as are sold, in different colors, at department stores. They are made in thicknesses ranging from 34 to 1/2 in. Use a pair of shoes as a pattern and mark around them, on the pad, with a crayon pencil. In cutting out the soles, use large shears, but make only short cuts (Fig. 1).

By Kenneth Murray

Now thread a large darning needle with a length of black knot-work cord, and stitch the edges of the soles as shown in Fig. 2. Make the stitches wider on the top of the sole, and slant the needle to the inside as it is pushed from top to bottom.

Twenty 5-ft. lengths of strong white cord were used in making the uppers of the shippers illustrated. Of course you may also use colored cord, or a k calme cord, if you wish. Each cord, after bring doubled, is anchored to the sole stitching as shown in Fig. 3.

make widely spaced square knots by tying the outside cords over the inside cords of each set of four, as shown in Fig. 4. This is continued until the toe covering is partly knotted, when the slipper should be fitted to the foot (Fig. 5). You can get a perfect fit by making the knots closer or wider apart. This is very important Fit the slipper often, and space the knots accordingly.

the knotting back, towards the heel. Fasten the work down at each side (see Fig. 6) so that the knots in the middle can be made more easily. After all twenty of the cords have been knotted, it will be necessary to anchor each row of knots to the sole by passing the cords on the sides through the loops of stitching,

When the knotting has been carried on as far as necessary, it is finished off with a row of half-hitches (Fig. 7). Take a loose cord from one side and bring it across the width of the slipper, over the mstep. With each of the other loose cords, make from one to four half-bitches over the single cord, as may be necessary for the correct length of the row, Pull the half hitches (which are ordinary "granny" knots) up very tightly. From the underside, cover them with ordinary nai, polish, which will penetrate quickly and, in drying, make the knots very hard. You can then cut each cord off closely with a razor

The slippers might be completed here, but it is better to sid a thin lesther sole to protect the attiching cord from wear Rubber cement may be used but a stronger ma estal notice of our page as



Fig. 5. As the knowing proceeds, the sipper should be fitted to the loot. Then the knote may be spaced closer or wider as found notessary

Starting with the four cords at one side,

After the toe part is well tander way, carry

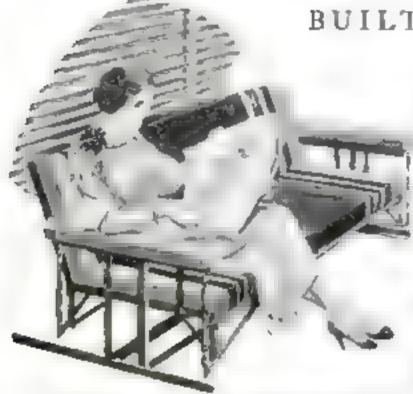
Fig. 2. Stirches should be made around the edges. of the soles with brack knot work cord in a sares derning needle. Have the statches on the top wider and closer to the suige

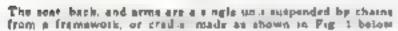
Fig. 3. Twenty lengths of white or colored working cords are used. Each should be doubled and all poed under one of the sole stitches

Fig. 4. W dely spaced square knots are made with each set of four cords, the two outside cords being tied over the inper cords. Continue until the covering is partly knotted

Gomfortable Porch Glider

BUILT FOR TEN DOLLARS







By Charles F. Deerwester

TELL-MADE porch gliders are expensive, but a comfortable one can be constructed at home from angle from and bar stock, a length of chain, an old cotton mattress, and the link springs from a discarded cot. A cost of ight green enamel and slip covers of light orange completed the glider illustrated. and the total cost was slightly under ten dol ara.

For the seat and back frame, 134-in. angle from is used, and for the cradic and urm supports, 15%-in. After the angle iron

has been obtained, it should be cut into the following lengths: 144-in, angle-3 pc. 73 in. long, 2 pc. 24 in. long, and 2 pc 19 in. long; 1/2-in. angle-2 pc. 32 in. long, 2 pc. 7934 in. long, 4 pc. 21 in. long, 4 pc. 25 in. long, 2 pc. 8 in. long, and 4 pc. 11 in. long

Some 1/2 by 1/2 in, solid from is desirable for leg bracing and also for the support upon which is mounted the chain by which the swing is hung-4 pc. 25 in. long, and 4 pc. 15 in. long. The chain should have links about 155 by 135 ln. and should be cut into 4 pc. 18 in long

Mount and bolt the two 7045-in, pieces to the 32-m, and pieces as indicated in Fig. 1. Use 1/2 by 3/16 in, store botts for the assembly. Next bolt the two 21-in, uprights to each end and surmount these with the two 25-in, pieces, one at each end.

Next, assemble the frame for the seat Mount the two long members, angle edge down, and the end members, angle edge up, as indicated. Measure the mesh of the cot springs and drill boles around the frame to accommodate the amal book springs. Mount the springs within this frame and attach the legs and leg supports as in Fig. 2. Although it is necessary to brace the lega from both angles, this not required in building the cradle.

After the seat has been assembled proceed in a nimilar manner with the back. All the angles on the frame for the back point in toward the seat. If the back is set properly into the seat frame and bolted on at the proper angle, no bracing need he done. Next insert the springs into the back frame. Hook the springs along the bottom edge into the same boles as were used in the seat for the seat-hook

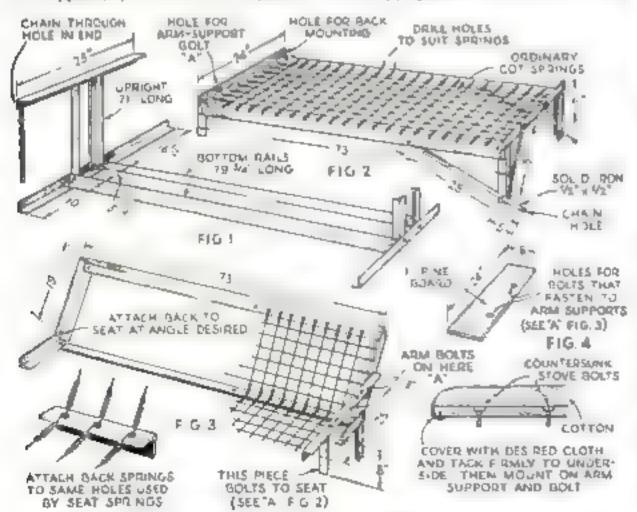
Put the arm supports in place and set the entire assembly in the cradle, suspending it with the four lengths of chain. Cut the end links on each chain and spread into hooks; then attach to the holes in-

dicated to Figs. 1 and 2

The arms are made of any available wood, with boles drilled to match those indicated in Fig. 3. Countersink the bolts to prevent turning, apply sufficient cotton padding, and cover with the desired (abric. This cover should be tacked firmly to the underside and the edges sewed shut with the ordinary type of baseball stitch. After completing the arms, mount them in place and bolt on tightly

Any size maitress can be reduced to the desired size by cutting the cover, removing the cacess, and resewing. The seat cushion should be 24 by 721/2 ip., and the back cushion 20 in wide. The back cushion will then be 1 in, wider than the back frame but this is to allow for contraction.

Paint the ironwork any desired color



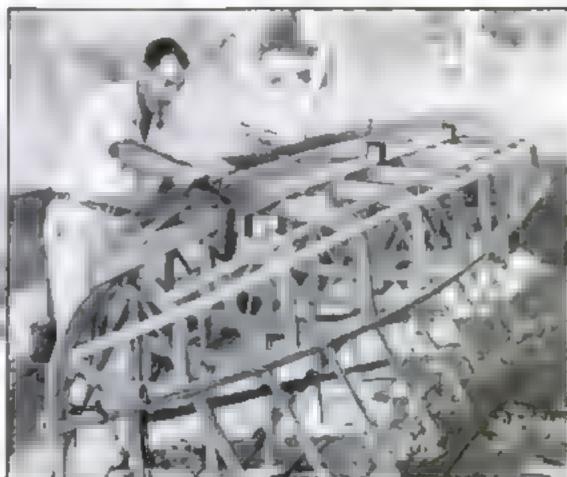
How the cradic and east proper are constructed. The dimensions may be modified if desired

PLANKING AND FINISHING OUR NEW

Racing Runabout



Storn view of the new stapless by drop and designed especially to meet national racing rules. Note arrange



By WILLARD CRANDALL

e de neo bi

BRUCE N. CRANDALL

13-ft, outboard racing sunabout has been completed to the point described last month (P.S.M. June '35, p. 60), it is ready to be planked

Three bottom battens are required on each side of the keel. They should be placed so that the plants will all be the

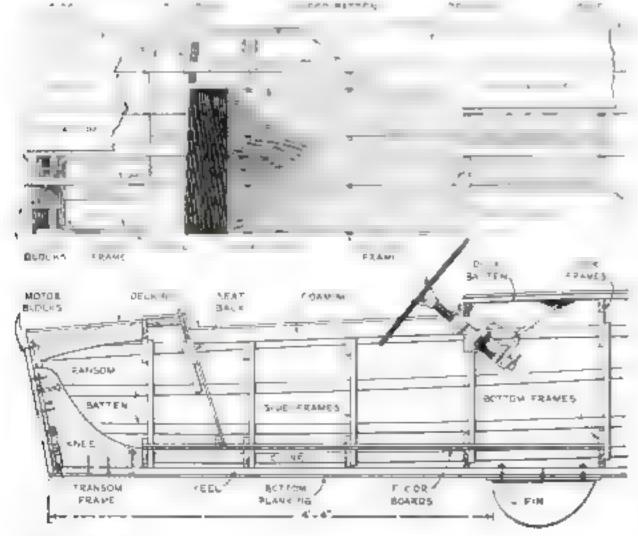
same width at the transom. Forward, the battens should be placed essentially as shown to the drawings. The side batten next to the chine should run at the water line from the transom to frame No. 8. Take particular care in fairing up the upper side batten (the sheer line), as it will make a great deal of difference in the ap-

pearance of the completed boat. Fasten the battens to the stem, frames, and transom frame with 154-in. No. 7 screws. It will be best to check the entire framework again before starting the planking, to make sure it is perfectly true and fair. A light batten laid over the frames will show any unexennest.

There will be five bottom planks on each side of the keel, all of which will require fitting. If the buttens are spaced approximately as shown in the drawings, the first two planks on either side of the keel can be made from 6-in, boards, but 8-in, widths will be required for the rest of the planking. All the planks should be fitted so that the seams come exactly over the center of each batten. The various planks can be fitted by clamping them. in the proper position and then marking them from the inside along the hattens with a pencil. Then, with the aid of a hight batten, mark out the shape of the plank, first adding to each side of the plank one half the width of a batten

Another method of marking the planks is to chalk the center line of each batten before clamping the plank in place. Enough of the chalk will come off on the plank to show reasonably accurately what shape it should be. An ordinary pencil compass will also be of use in marking the planks for the final fitting. The planks below the water line should not be fitted together tight, the scams should be left open about 1.16 in, to allow for swelling.

The outside bottom plank will have to be made in two pieces, spliced as shown between stations 5 and 6. It will also be easiest to stop the third and fourth plank (counting out (Continued on page 92)





HOMEWORKSHOP GUILD Shows What

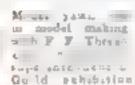
THAT the National Homew. L. E. p. Gu ld has altrady accumpushed in encouraging amateur cenfismanship throughout the country can be judged by studyng the examples of graftwork ilin his and following pages. These photographs supplethose published last month, when the prize winners in the first National Handicraft Exhibition and Control were announced (P. S. M., June 35 p. 57).

Innueserable letters and newspaper clappings have been received nenting upon the exhibition. They are all in agreement that the work being done by the Guild to get

clubs organized represents the greatest step. forward ever taken in the home workshop field. The success of the exhibition was immediately reflected in the increased membership of many clubs, particularly those in the Chicago area, and many inquines as to how to start new clabs.

In checking up the records of the national contest, it was found that the star performer of the great Chicago show was A. O. Stenwick, a member of the Red Wing (Minn.) Homeworkshop Club. He won first in Division 7, novelties and toys, second in Division 3, furniture made with hand tools, and a special silver meda. in Division 8, model making

Mr. Stenwick, a photograph of whom appeared in the previous fusue (P. S. M.,







These four pieces, made entirely of sefery matches, won for Fred Spinden. of Ab again. I'll second price in the division devoted to pove ties and toys. The rea kettle and codes put are bollow-only as thick as one match

Reproduction of a thirteenth century vertment chest made from wood taken from an imported thest of drawers known to be over 100 years old. It won second prize for Theodore T Clemesha. of San Dargo, Calif., in the machine-made furniture division





A turned puffet set—fruit bowl and two candlesticks—made of walnut and white holey with an inlay is the center of the bowl of veton, ion and waining act in holly in the form of two birds. This entry won second price in the wood turning division for Robert B Dyer, of the Lincoln Nebt) Homeworkshop C ub, and was also awarded the Popular Science Craftwork Meda) in the social exhibition of the Lincoln C ub

Its Members Can Do

A PICTURE RECORD

OF OUTSTANDING ACHIEVEMENTS

BY AMATEUR CRAFTSMEN

June '35, p. 94), is 60 years old and has been doing woodwork since he was a small boy. Some time ago a wanut tree on the grounds of a hospital across the street from his home blew down. He obtained part of it and sawed out a section which he split in half from one of these halves, he corved the hon in the cage that won first prize in the novelty division. After roughly shaping the brock, he drew once representing the bars of the cage, bored a number of holes between the bars, and the last of the cage, bored a number of holes between the bars.





M At 5
C Pg s
c At
A P E P
A A E
Me A 4 E
Me 3 Wath N
Or e h er

A complete of the charts of the charts of the confidence of the confidence of the complete of the charts of the ch

Switch Saves Money on Photo Lamps

And Other Hints for Amateur

PHOTOGRAPHERS

The lamps are used at full brilliance only while the picture is actually being taken

A DEVICE that will give the amateur photographer complete control over his photogood lights may be easi-

ly constructed from parts
obtained at a large ten-cent
store or electrical supply
house. The writer used two
small three-way flush
switches at fiteen cents
each; two duplex flush re
ceptacles at ten cents each
and two cover plates (each
panie to accommodate one

switch and one duplex receptacle, at

twenty cents each.

Carefully saw 36 kg, from one edge of each cover plate—the edge where the slot is provided for the switch lever. This enables the switches to be placed closer together facilitating the operation of both switches at one time. The plate should be held between two pieces of wood while being sawed.

The frame consists of two strips of wood 34 by 134 by 834 in., and two strips 34 by 134 by 3 in. A hole is drilled in the center of one of the longer strips to provide for the lead-in wire. The bottom is made of plywood or other thin material 434 by 834 in, and may be covered with let, if desired

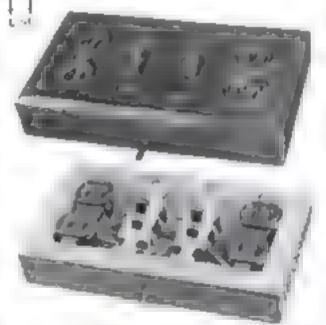
In the wiring diagram, each switch 5

is represented by dotted lines, and the terminals are indicated by black circles. The white circles connected by dot-anddash lines represent permanent connec-

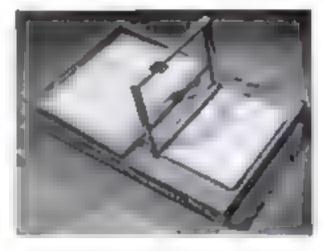
tions made within the switch by the manufacturer. They are not to be used. The large circles R indicate the duplex receptacles.

When both switches are "off" and two photoflood lights are plugged in opposite sides, the two rights will be in series. They may then be used for arranging the subject and for focusing without shortening their life. If either switch is now mapped to "on" and the other switch left at "off," one light will be put on full brightness and the other will be extinguished. If, however, both switches are snapped to the "on" position, both lights will burn at full brightness. When using four photoflood

lights, all four receptacles may be utilized, the operation, of course, being the same as if two were used,—Wilteam H. McClain



How switches and receptacion are meanted, the completed device, and the wiring diagram



EASEL HOLDS TWO SIZES OF ENLARGING PAPER

ENLARGING paper may be held flat on the table and neat white margins obtained all around the prints by using a homemade easel like the one illustrated. It is for two of the most commonly used sizes of paper—5 by 7 and 8 by 10 in.—but it can easily be made for other sizes.

Obtain a baseboard of well-seasoned wood at least 35 in, thick and slightly larger than the size of the paper you are going to use. In the case of a double frame (as in the photo above), add the widths of the two frames plus about 3 in. Next, cut a frame from molding which has a 14-in. rabbet. This should be 1/16 in, larger each way than the size of the paper to be accommodated, or \$1/16 by to 1/16 in. for 8 by 10 in. paper. It might be well to have the frames cut from plain molding at a picture framer's unless you have access to an accurate miter saw The frames are then hanged to the baseboard, and small spring-brass clips are fitted as shown.

The paper support, which may be of cardboard, must be equal in thickness to the depth of the rabbet. Cut it slightly smaller than the size of the paper to be used. A pacce of white paper may be pasted on top of this to facilitate focusing and composition.—Alexar C. Mason.



LENS SHADE FOR TEN CENTS

OF THE many camera lens shades I have tried, one made from a tencent tearup of the so-called "beetleware" type is the most durable and satisfactory. Remove the handle by sawing or filing. Tap a hole in the base and enlarge it with a round file. When it nears the outside diameter of the lens flange, finish with sandpaper and try frequent fitting to obtain a soug fit. Velvet may be cemented around the edge to prevent acratching. The whole shade also may be covered with matter black, if desired.

I made the shade illustrated in less than ten minutes. If fitted carefully, it is easily put on and taken off. For a smallersized shade, get a wine glass of the same type of material.—Frank MacCarrey.



MARKING THERMOMETER FOR DARKROOM USE

STIRRING-ROD thermometers of the type commonly used by photographers are difficult, if not impossible, to read in the dim light of a darkroom. They can be marked easily, however, by dipping a length of black thread in shellac and wrapping it around the glass at the point that indicates the desired temperature, as illustrated above.—W. EDWARD WILTE.

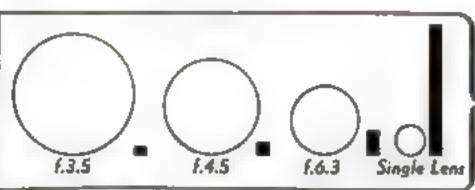
LENS SPEED...what it is...how to use it

THE faster the lens on your camera, the less light you need to take pictures. And the less light you need, the greater the variety of snapshots you can take.

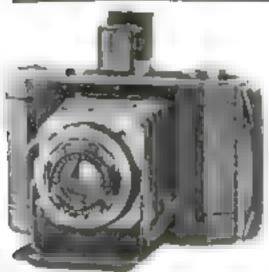
Lens speed is denoted by an "f" rating—such as f.4.5 and f.6.3. The smaller the "f" number, the larger the diameter of the lens...hence, an f.4.5 lens admits more light—is bigger, therefore faster—

than an f.6.3 lens when fully open.

When you buy a camera, get one with a good fast lens. It will let you take pictures at higher shutter speeds . . . and even indoors at night with Mazda Photoflood bulbs. Of course, you won't take all your pictures with the lens wide open—but, like a high-powered automobile, it's nice to have the extra power when you need it.



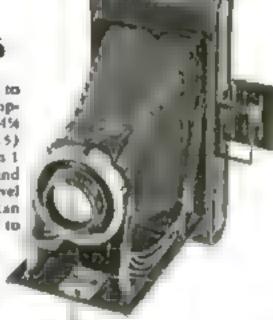
• Circles indicate relative openings of various lenses. Bare indicate relative times of exposure necessary. The bigger or faster the tens, the shorter the exposure that is needed. Notice that an f. 5.5 lens is 16 times faster than an ordinary single lens ... thus, you can take action pictures at 1/400 second with an f.3.5 camera where a 1/25-second exposure would be required with an ordinary camera.



1.4.5 KODAK SIX-16

(right)

Kodak Six-16 with f 4.5 lens will appeal to those who know fine photographic equipment. Is taken a standard-size picture—25 x 456 inches. Its fast Kodak Anastigmatiens (f 4.5) and the Comput shutter with speeds from 1 to 1/250 second give you mastery of light and "action." Both conventional and eye-level finders. With the built-in self timer, you can get in the picture yourself. Focuses down to 4 feet—for fine close-ups. Costs \$40.



f.3.5 KODAK DUO

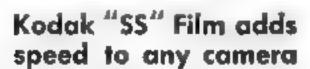
(ubeve)

, the miniature Kodak that makes a larger picture. In the care indoors, almost anywhere, at night with Photoflood bulbs, the crisp, sharp f 3.5 lens lets you take pictures. And the Comput shutter gives you speeds up to 1/300 second—fast enough to "stop" an express train. Just a handful of camera, this miniature Kodak gives you sixteen pictures on a roll of 620 Kodak Film. And each picture is 10 x 24 inches, large enough for your album. Complete with depth-of focus scale... Kodak Duo Six-20 coma \$52.50.

f.3.5 KODAK RETINA

(left)

This miniature Kodak is huilt for speed. A 1/500-second Comput shutter gives you command of action—and the keen / 3.5 anastigmat lens admits ample light for high-speed exposures in difficult light. Thirty-six pictures, approximately 1x1½ inches, at a loading. And it's a real camera bargain. Complete with optical view finder, depth-of-focus acale, plunger release—Kodak Retina costs about half as much as cameras of aimiliar range—only \$57.50.



Kodak Super Sensitive Panchromatic Film is a high-speed film for high-speed cameras—but it

opens new picture possibilities to any camara. Try a roll or pack of "SS" Film—you'll find it helps get the pictures you may have missed before.





FREE! KODAK CATALOG

16 pages of information on Kodeks and plustagraphic equipment. It's yours for the asking. Instruce Kodek. Company, Rochester, M. Y.

Hema.	
Address	
City	State

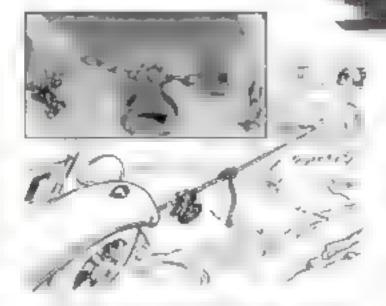
OUR READERS CONTRIBUTE THESE

Timely Hints

FOR CAR OWNERS

Shock Absorbers Save Tow Rope

FTER mapping at least three towing rigs pulling cars out of deep ditches and mud. I decided to find a way to ease the strain of the first hard jerk that invariably brake the rope or cable. The resul is shown to the illustrations. It consists simply of two oldstyle spring shuck absorbers bolted together, short lengths of pipe being used as specers. Lengths of chain then were failened to the arms to serve as connections to the car and tow rope.—A. E. G.



Shock absorber on tow rope heeps first jerk from breaking in

Courselels gon food atmosphing genering un hill

Throttle on Gear Shift

FOR starting a car on a hill without slipping backwards, few tricks are more effective than the homemade genr-shift gas-throttle illustrated. It allows you to use both feet on the pedals and yet leaves your hands free to guide the wheel and work the shift lever. The throttle is simp.y a trigger rod salvaged from a truck shift lever. It is mounted on the gear shift and linked to the carburetor throttle lever through a flexible cable. The band that shifts gears can feed the gas.-C G

Replacing a Valve Spring

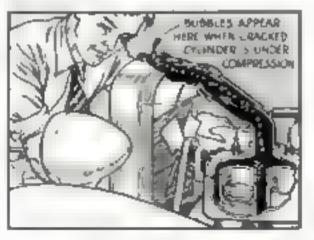
an overhead motor, it can be replaced easily without removing the head. First remove or loosen the rocker arm. So der a length of wire



to the valve stem and loop it over the radiator rod. With the wire to prevent the valve from failing into the cylinder, the locking pin and washer then can be loosened and the broken spring removed. The new spring is then attached.—N. E.

Tracing Cylinder Cracks

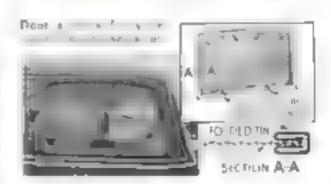
WHEN a motor develops a casting crack or a gasket leak and water seeps through into a cylinder, it is often difficult to determine which cylinder is at fault. To trace the leak without removing the head. fill the radiator with water and run your motor to bring it up to driving temperature. Then remove the radiator cap, shut your motor off, and turn it over slowly by hand. As the cylinder with the leak comes under compression, fedtale bubbles will appear at the radiator opening.—E. J. N



How values can be feetened to running bourd of one

Luggage Carrier

FOLR holes praced in the metal splash apron along the side of your car will provide a handy means for fastening luggage, camping equipment, or hu ky packages to the running board of your car Strong cotton rope looped through the boles and under the running board will hold any sort of baggage in place. To prevent the rope from chafing on the sharp edges of the metal, each hose should be fitted with a metal awning grommet. The holes do not mar the appearance,-E.A.K.



Screens for Your Car

YOU can make your car as mosquitoproof as your home by fitting it with the easily made door acreens illustrated Each screen frame is made up of four pieces of sheet tin folded U-shape and soldered to form a rectangle that is a tight fit inside the window opening. The screening, pushed into the open channels formed in the frame, is put in place hefore the parts are assembled. Two books sordered to the bottom edge of the frame rest on the top edge of the partly raised window to hold the screen securely in place.-E E H

Jack Extension Arm for Low-Slung Cars

wheels on my new streamlined car, I devised the permanent spring extension

arms shown. Consisting of a right angle of three-eighths- by seveneighths-inch steel bolted to the shackle on eath rear spring, it provides a handy projection to take the head of the jack. The jack is simply placed under the extension and raised. As it moves up, it first pulls the spring out flat

TO MAKE it easier to jack up the rear and then taises the wheel. Since the arms do not interfere with the spring action, they may be left on permanently.—C. F.



Extension arm clamps on spring so jack can lift low car



Do NGT be too basty in discording short drills. They prove heady where the work will not permit the use of a long drift because of the limited capacity of the machine or the size of the work. They also make good counterstaks and specially formed two-lipped and mills.

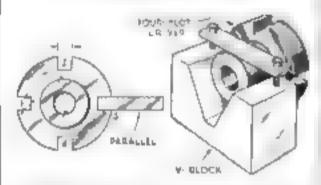
Keep all threading tools good and shorp. Taps, dies, and chusers have a positive lead and their cutting edges do more work than many other metal-cutting tools, where the feed to governed by the operator.

To drill aluminum, a 140-deg, included the angle is recommended and the enting rates should be atoned. Use a higher speed and lower feed than required for steel.

Use a cup wheel as much as possible for sharpening milling cutters, side milts or end milts. A susting edge resulting from a flat clearance will double the time between grands.

In case any endiess cannot helt gets too louse, each it in hot mater and allow it to dry overnight.

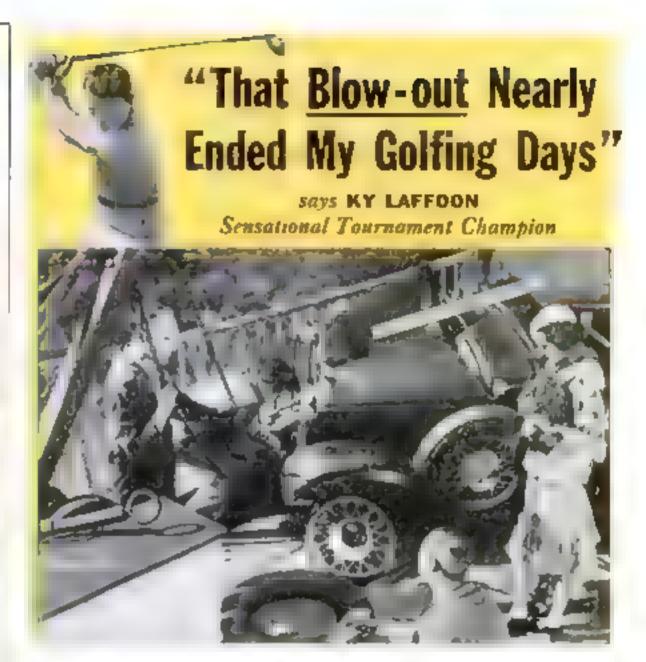
SPACING SLOTS WITHOUT A DIVIDING HEAD



INGENUITY often makes it possible for small marking shops to do work for which no adequate equipment is available. An example of this is the four-slot driver illustrated. It has four 1 in slots equally speced. These were ground within close limits without the use of dividing-head equipment.

First the rail of the magnetic chuck was ground true. Then the driver was mounted on the magnetic chuck by means of a Y-brock as shown, and slot No. 3 was ground to the correct depth and central to the hub. This was checked by holding a square against the hub and using a gauge block in the slot gauging from square to gauge block. A 1-in parallel 3 in long was next inserted in slot No. 3, making a tight fit. The slot was then turned 90 deg., the parallel being set with the aid of an indicator.

Stot No. 2 was finished in the same manner. The work was then awing back to the opposite position and the parallel indicated again so that not No. 4 could be pround. Finally 1-in, gauge blocks were fitted into slots Nos. 2 and 4 and indicated parallel, and slot No. 1 was finished.—F. J. Williams.



NEW GOODRICH TIRE SAVES LIVES

ONE of the blow-outs I had came not finishing my golfing days for good," says KY LAFFOON. "I was driving along about 45 or 50 when suddenly I heard a foud crack, like a backfire. I tried to steer, but I don't believe ten men could have held that car on the road. The car headed for the ditch. I heard a crash—and that's all I remember. Believe me, I m lucky to be able to swing a golf club

after that blow-out. So I'm not taking chances on tires these days. My car is equipped with Goodrich Silvertowns."

Heat, generated lastife the tire by today's

high speeds, is the great, unseen cause of blow-outs. And the hotter the roads get the greater the danger from blow-outs. Rubber and fabric separate far more quickly. A tiny bluser forms. Slowly but surely that bluster grows bigger—BIGGER until, sooner or later, BANG! A blow-out. And, usually, there's another job for the wrecking crew.



FREE Handsome emblem with red crystal references protections if your tail light goes out. Not to the Groods of detact to a business per one Hell Or to 100 to 200 cm packing de mailtage). Dept. S. A. Loy B. F. Groods a by the Control of the Contro



Safer in two ways

Pet GOODLCH Safety Silvertowns between your car and the road. They re the only tires with the Life-Saver Golden Ply—the GOODRICH invention that resists this totateal heat and keeps blisters from forming. That's why Silvertowns give you read protection against high-speed blow-outs. And, what's more, the big, high-cleated Silvertown treads give you added protection against dangerous "tail-spin" skids.

Make every drive you take this summer a real pleasure trip... free from tire worries. Put a set of Golden Ply Silvertowns on your car. Remember, they cost no more than other standard tires and give months of extra mileage.

Copyright, 1935, The B. F. Goodrich Co.

Goodrich Safety Silvertown



H² never used his sword. He didn't have to. But he did produce his stewy old brian, loaded at with El Terrifico tobacco-and blew some the bull's way. Curtain.

Even a bull can't stand the charge of a dirty pipe. But even a baby enjoys the fragrance of a mild tobacco like Sir Walter Raleigh amoleed in a respectably clean briar. It's an unusual mixture of gentle Kentucky Burleys -well-aged, slow-burning, easy on the tongue, It's a hand tobacco; your kind. Try a tin and see why Sir Walter has become a national favorite. (Kept fresh in heavy gold foil.)

Brown & Williamson Tohaces Corporation Louisville, Kentucky, Dept. Y-57



It's 15-AND IT'S MILDER

ANTIQUE

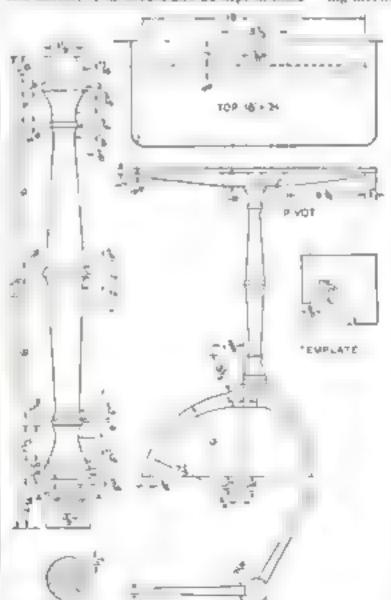
EL BULLDOZER! Tip-Top Table

Measured drawings of a beautifully proportioned eighteenth century piece

By CHARLES PRICE

HROUGH the harmotrous repetation of straight lines and tapers, an unusual perfection of design has been achieved in this eighteenth century mahogany table. The original a genuine antique-is shown in the photograph. It should be noted that the tapered portions of the column are not perfectly straight, but have soght fusiness that overcomes any feeling of skimpinets.

The material should be mahogany of walnut although maple may be used In turning the column, try to get a crisp effect by not rounding any edges that should remain sharp and distinct. This should also be kept in mind



Drawings made from measurements of the original antique. which is shown in the photo. Note template for mortises



when using sandgaper Use No /2 sandpaper first, then finish with worm No O grade All sanding a done with the tathe running at fall speed. A sense of one hom will be left runring around the work these are removed by sanding up and down with the grain while the table a not running lise a piece of well-worn fine sandpaper for this. The work is then taken out of the lathe and the surplus ends sawed off

The top end of the column is cut down from the round to form a square tenon 11/6 in. on a side. This fits snugly into a corresponding mortise cut in the block, which should be

giued in place and fastened with a dowel passing through the side into the tenon on the column.

The feet are mortued to the column. A template made from good stiff cardboard is necessary to get the mortnes at the right angle. Measure the diameter of the base of the column and make the radius of the arc exactly half The width of the projecting portion of the template should be measured from the center line. With a pair of dividers, mark off three equal spaces on the shaft. One mark should be directly in time with the center of the block on the other end of the shaft. This is necessary to insure the top being equally in line with both forefeet when it is tipped up When laving out the mortises, it is advisable to clamp the base of the shaft lightly in a vise. Get the space mark in the center of the vise jaws the edges of the vise can then be used as guides Dril. with a 5 16 in hit and use the template frequently would chiselmg out.

The feet are made of straightgrained wood free frum any defects, the grain running in the general direction of the fee. Time will be saved by laying out a flot on cardboard and tracing all three feet from at Saw the feet on a band saw and plane them to the required taper. Finish the curves with spokeshave, fi.e. and sandpaper Cut the tenons one at & time to fit the shaft souply and number each with its correspondme mortese. The end of the feet that fits against the shoft will

have to be worked down with a gouge until

a close joint is obtained.

To glue the feet, put a wooden hand screw on the foot so that it is parallel to the shaft when the foot is in place, An iron C-clamp may then be used to draw the foot down, one part bearing on the wooden clamp and the other part on the shaft. A block of soft pine should always be placed between the clamp and the work. Clamping in this manner will allow only one foot to be glued at a time, but the joint will be stronger than a possible to get in any other manner

The top of the original table is made up of two pieces 101/2 in, wide and 18 in, long, Gluethe preces together, plane the surfaces, and select the better for the top. Plane the edges,

	List of M	ALCIT	110	
N of	Description	r	17.	ī.
C. HELL IS M	-		- 1	7
2	The less			41
	չ վայուսը 1950-ի	1 2	. 1	3,
1	Fee	. 6	7	,

draw 1-in area at the corners, saw the corners. and finish with file and sandpaper Sand all edges enough to remove the sharpness

Make the two cleats as shown and fasten them to the top 4 in, apart with screws of various lengths. The top of the front edge of the block, which is prvoted between them, is rounded to allow the top to tip up. Two screws are used as pivots. A ratch of the type reportally designed for tip tables should be fastened to the top to hold it in place If a remous catch cannot be secured, a small but ton on a brock will answer

The work is now smoothed all over with No. 00 sandpaper or fine steel wool and dusted off Regular oil stain, brown or red in color muy be used. With a little more trouble, how ever, a stain preferred by some craftsmen may be made—ten cents' worth of potassium bichromate mixed with a pint of water If this or any other type of water stain is used. the work will have to stand for an hour to dry It should then be rubbed with fine steel wool, as the water ranes the grain of the

wood slightly

A coat of paste wood filter is next applied If the proper color is not at hand, a few drops of regular oil stain may be stirred with natara, wood filler to obtain the right shade. The filler is brushed on the work, a small portion at a time, and when it shows signs of drying remove the surplus by rubbing across the grain with a cloth. Allow the filler to dry overnight, Two coats of thin shellac are then applied, the work being subbed with steel 1 woos after each coat. A coat of furniture way thoroughly rubbed, will give a pleasing sheen and complete the firsh

REMOVINGWEATHERPROOF COVERING FROM WIRES

WEATHERPRING madation, which is hard to cut, may be removed from wires more easily with a hammer than a pocketknife. Use light blows on the end of the wire while it is held against a brick wall, concrete, or any other hard starface. Under the blows the copper conductor quickly breaks through the insulating material - Louis N Goodsias

"WIRE" EDGES BUFFED AWAY

THE so-called "wire" edge on wood-cuttang tooks (chisels, planes, gouges, and pocket knives) can be quickly removed with water and pumper stone on a cloth buffing wheel laft the tool from buff frequently and use plenty of water and light pressure to avoid injuring the temper This is especially handy on gouges .- M. A. Coopen.



SHARPEN RAZOR BLADES THE EASY WAY

This fast, clean cutting, velvety emooth hone has proved that fuseing and cussing around with complicated sharpeners is a waste of time and money.

With your Aloxite Brand Hone,

n few light strokes as illustrated above will put a keen new edge on any double-edged blade. Get an Alexate Hone in any drug or hardware store—and then you can shave in perfect comfort.



NO TOOLS NEEDED WITH THIS LAWN MOWER SHARPENEE

Two minutes, and this Curborandum Brand Sharpener puts every blade on your lawn mower in perfect cutting condition. It hooks on, comes off in a pifty - not even a screwdriver or a pair of phero is needed. Two sizes, 50c and tire in 1 S. A. At your bardware store or direct.



SHICKES SMYTE SHARPS WITHOUT SCRATCHING

Here's a sharpener designed expressly to keep statuless steel knives sharp without marring or ecretching the brantiful finish. of the blades. It's known as the Carlmens dum Brand Roosehold Sharpener No. 06 and costs only 35c in U.S. A. At your hardware store, Green, yellow or blue bandles.

THE CARBORUNDUM COMPANY

Send for handy pocket size sharpening stone and 26-page booklet "The Art of Table Carting," 19 large illustrations. Both are yours for only 10c.

MAIL COUPON TODAY



The Carbonadum Company Dept. P.J. Sugara Palls, N. T. Exclused in ten contr (coin or stamps) for your leashful. The Art of Table Laving. and sample Sharpening Soone



Build an exact scale, electrically lighted model -- 18 inches long

4 BIG PRIZES!

AND MANY OTHER PRIZE

1. A Round trip to France 3. A Long Cruise

2. A Round trip to France 4. A Short Cruise

forcy one entering the contest will resolve a beautiful communicative model.

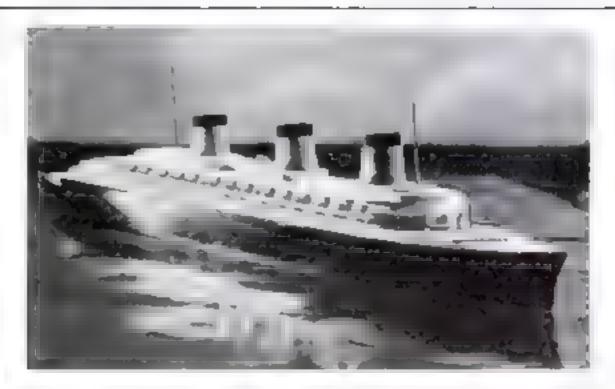
SPECIAL MODEL KIT, \$1 50

- A complete kit has been specially designed to simplify building. It includes a holowed half early assembled from factory-rat Balsa wood parts. All other necessary materials are provided such as wood for the superstructure, mast, rudder, paints, brush, sandpaper, electric lights, wire, model builder's kiefe and cement—nothing else to huy. Life bonts, anchors and propellers furnished fully finished,
- Full-sized plans are included, showing all steps in construction, and a picture of the Normandia in full colors. Any one handy with a knile one complete a realistic model.
- Entry blank, contest rules, list of prizes and judges' names included in each set.

NO ACT LIMIT—OPEN TO BOTH SEXUS—Control starts April 23, 2003—closes February 25, 1936, Model him may be bought at department stores, sporting goods dealers, and habby shops. Or divers from 10 (\$1.30 pins 35 cents for passage and packing).

MODEL BUILDERS' GUILD

DEPARTMENT G, HEMPSTEAD, NEW YORK



SIMPLIFIED MODEL OF THE NORMANDIE

(Continued from page 50)

then be reduced to ½ in, in width, and four boats cut off. Two will serve as boats, and the other two are to have one end rounded as shown by the dotted line to form the streamlined ventilators that are fastened to piece Z (see Fig. 1). The two ¼ in, boats may be shaped out of scraps of wood

Fasten the lifeboots to the paper strips so that they just touch the wire runways that constitute the new type davits with which the Normandre is fitted. The two small boots are directly behind the bedge; then follow the two motor launches; and the twenty-six regular boots fill the remaining spaces. Take great care in fastening these boots to the sings, Then, if your work in building the superstructure has been exact, you will find that the first six boots on each side are evenly spaced, and that the remaining nine are in

three groups of three each, on each side With small account, clip off any part of the paper streps that may project

The funnels are of a peculiar shape. As Fig. 6 shows, the base is wider and longer than the top. Cut the 76 by 114 in stock into three pieces, each 11/2 la. long. Draw center lines all around the blocks thus formed. Make exact patteres on cardboard of the base and top. Trace these shapes on the blocks. Whittle away until each funnel looks like a section of s streamlined cone. Next cut away wood on the sides so that the shape of the top drops perpendicularly until it is within 14 in, from the base, where it starts to flare out. Now trim the tops. In doing this, note that the front edge of the first funnel remains the full 13% in. it originally was, while the second is only 1 1/10 in. (Continued on buce 77)

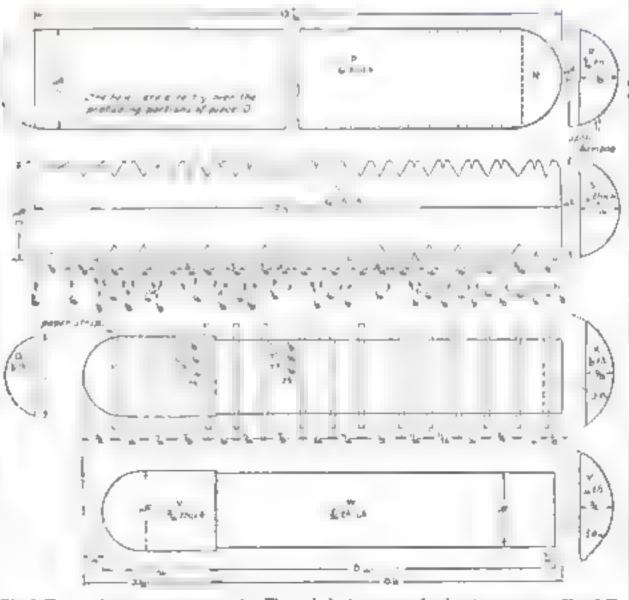


Fig. 3. How to shape superstructure twits. The scale is the same as for drawings on pages 58 and 59

MODEL OF NORMANDIE

Continued from page 70,

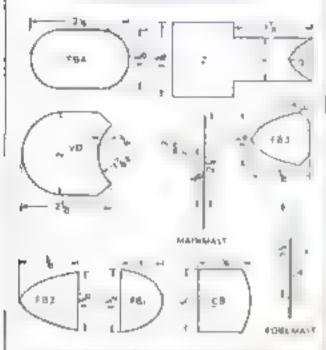


Fig. 4. How to lay out the seven top dech housings and make the forement and maintainst

long, and the third, I in long

The mosts are long needles of wire. The foremast has a small piece of round wood for a crow's nest. A short wire featened with iquid solder or heavy glue forms the galf for the manufact.

Above the water line the sides of the hull unit are painted a semiglossy black, and below the water line, red. Only the portions of the drek at the stern that will remain exposed are to be painted buff. The edge of J and J should be white. The inside of the swimming pool needs a touch of bias-green for mater, or colored paper may be glassed on

The side edge of E is pointed white, all around. The whaleback and breakwater M are the pointed white. The decks aft of the breakwater and the derrick booms are but as is the exposed portion of the deck aft After the point is dry, a small piece of white card is fastened to the deck forward, between the derrick booms, for a batch cover. The faste sheer is now pointed on the edge of E starting at a point about opposite the derrick booms, until the black point covers the full thickness of E at the bow

The entire superstructure is first painted white. The wings of the captain's bridge (Y) and the top of FB', FB', FB', FB', and VD are then pointed buff. The masta are brown, and the funnets vermilion, with a black band 1/4 an, wide at the top.

When the point has dried thoroughly, the model can be assembled. Deck E is glosed to the hall unit. The superstructure unit can then be glosed and nated to E. The nais should be placed where they Communed in page 742



Bow view of the model. Even no small model, the ship gives so impressing of immense size



He <u>looked</u> a bit seedy but <u>felt</u> like a tramp

-when he tried to get by without shaving

War suffer the embarrassment of feeling unkempt when a clean abave is so quick and easy with the Gillette "Blue Blade"!

This remarkable blade is ground, honed and stropped automatically especially made to glide across tender faces without a trace of harshoess or irritation. You get more shaves, better shaves, and a feeling of satisfaction obtained only with this blade.

Hardened mantematically controlled furnaces where the temperature instantly changes in accordance with the exact requirements of the metalthe Gillette "Blue Blade" is always uniform—takes and holds edges that actually will cut place.

Get the benefit of matchless equipment and manufacturing skill. Sup a Gelette "Blue Blade" in your raror tomorrow morning. See how it is "anchorwrapped" in its envelops with four binders of wax to protect the edges from damage. Take a few long, easy strokes across your face and you'd realize you are getting the absolute "top" in shaving comfort. Buy a package of Gilette "Blue Blades" on our money-back guarantee of antislaction.

Reputable merchants give you what you ask for. In storm where substitution is practised—INSIST ON

GILLETTE BLUE BLADES NOW 5 for 25 t · 10 for 49 t



The ARISTOCRAT

— New Gillette

One Piece Russe

The Arctorrat is all one piece, no loose parts. Heavily plated with \$4-karat gold and guaranteed a aletime. Price \$4 complete in smart leather cases with 10 Gillette "Blue Blades."



Max Boer, heavyweight fighter, stars every Monday night on Gillette radio drame "Lacky Smith". WEAF and associated N. B. C. stations.



Genuine Tempered Mesonite PRESDWOOD le an ideal material for outdoor use. Gerden furniture, birdhouses, pergolas, fences, arborn, cold frames and hundreds of other permanent garden fixtures can be made entirely of this grainless material. Also splended for concrete forms in building fountains, pools, walks, greenhouses, birdbaths.

PRESDWOOD defice wind and weather Mointure-resulting, it will not warp, chip or cruck. Can be used many times if destred. Natural warm brown finish biendy beautifully with foliage and soil. Or it can be varnished, painted, lacquered or enumeled with any standard application.

PRESDWOOD comes in light, durable boards, 36", 56", 36" thick. Available from leading lumber dealers everywhere. Can be cut or sawed to any size or shape without damage to tools. Reasonable price and long life make it a money saver wherever used.

Let PREEDWOOD go to work in your own garden. Send in the coupon today for a free sample to experiment with, and more information about this wonderful material.

111 W Washing	too St., Churago, III.	ra
P core sand m	and adar ions sterate	å Masonit ure
Name		
Address.		
Caty	State.	

Our BLUEPRINTS

Will Give You Expert Guidance

NO MATTER bow much or hitle time you have for your bome workshop activities, it pays to concentrate your efforts on worth while projects. To help you do his, we offer a series of blueprints for models, furniture, radio sets, toys, and other projects. The following list gives a wide selection, but many other

prints are available. Send a stamped and addressed envelope for a complete list

Our blueprints are each 15 by 22 lo. and emit 25 cents it sheet (except in a few special cases) Order by number The numbers are given in stalic type and follow the titles. When two or more numbers follow one title, it means that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by photo-graphically illustrated instructions which supplement the drawings, If you do not wish this supplement, omit the letter "R" from your order and deduct 25 cents from the price given. Instructions alone are 25 cents each

ROATS

B-07443		
*Canon. 16-ft. Convan Covered Rayak, with	ı	00
Duck Boat Fording \$20-R		30
Righ Speed Boar for Sma Outhoard Mc		25
"Outboard Racor 0 , dr 4 h 7:4 "12 R		Τij
Say bout Mr to boat Comb nation of fe		
Caticg of ISC 131 R	11	ρŷ
Marcons Rig with J h for Above 131 A		25
" 3 att Runabout or Sporth at outboard		
or inboa d major! a z t e f. R	10	οù
"12-14 Unity Rowboat aim be said or used with outboatd more 2.4-R		30
* 1.5t Racing Runabout, 262-263		50
Note: Foll-side patterns for an it at not do not do not do not do not to the set of the blues though one week in required to the order for just		

MISCELLANEOUS

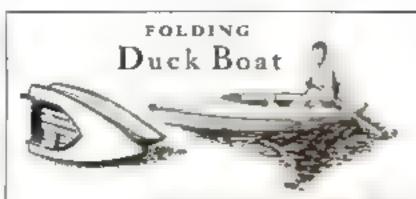
Arbor with Garden Gate and Beats, #	2
B 4 House Log Cation 1884	2
D - a House C- mat 22	ř
Do a Maure Politica 77	2
Garden Chair. 7604	
I og Cabin Three-Room, 156-R.	ļ,
Pro ector for Photon and Picturen, 259A	2
Star Chart, Perpetual, 214	2
Toy Drill Press, Lathe, Saw, etc., 123	_2

FURNITURE -

Bench and Tür Top Table. Combination, 11	.25
Carac Chast, Mahogany Trummed, 1	25
Chesra Treasure #	25
C fire Table with Spita Light 245A	75
Firende Seats (wood and me at 286A	25
Floor Lamp with T god Base 2444	25
Magazine Rack Ladder Rails S yte 750A	23
Pier Cabiner and Hang ne She ves. ??	25
Lamps Modern so turning 93	25
Sewing Cabinets Two 37	73
St verwere Chest on Stand 2444	25
Table, Four Leaf Card 2594	25
Table, Tavers, and Strall Mirror, 105	,25
Tes Wegon, IJ	25
CHIR AND COACH MODELS	

SHIP AND COACH MODELS

Construction hits are available for? Lyome of these models, See game \$4., Aircraft Carrier-U S.S. Sarataga (18-in.) and flush deck destroyer (5td-in.), 276-177-R.
Bettlenhap-U S. E. Texas (3-11 hull 197 196-199-200 75 1.00



IF YOU want a light heat that folds up and therefore can easily be carried by not mobile build our at a cack boat. It is II is long weight about 70 b and is a cause y a such and stable. While it is negligible to be rad die user of the angle and the carried for rowing or a cance and right up for an ing. But, in and make one 50 cents with full aug parters, \$100 O der Buepring No. 170-R.

	Borrie Ci.pper Ship in. 773 122	.6
ĺ	Civil Wa. Ships Manrior Mer mac, and	
	Har and A y 52g and a g to many temperate y 22d	
		. 2
	Chapter Ship 20 1-18 bull), \$1-52-83-#	1 00
	Clipper, Sampiffied (014 in. hull), 211	. 1.
	Count tutton 21-th hall 27-50 SP Russian	1.0
	Cuper Booklyh b n 226	2
	Cruiser Tunckings Pin + 214	
	Descriper. b & B Presson 11 am hu'	1 0
	Galleon Revenge (25-in), 206-207-206-209	1.0
	Harrie d. Fa agus a Fagan p. 33 , h.	6.30
	has specie pross 221 222 A	1.50
	H M & Boung & , n hu 354	7
	Mardamer , 7 , th hu Brasas &	1 0
	M contrast 20 in Cru set \$4.44 R	7.
	Mororbust Working Made 20-in 164	7.
	loner Aguitab & P n 325	2
	Liner-California (12% sm.), 351	2
	Liner- Normandia 2014 n 284 285	В
	L use Manhattan 12-in, long , 204	.1.
	L ner- St. Louis Lelin.), 231	2
	Para ret o d ?- Swallow, a Balt maco	
	Property of A 2-Swallow, a Balt more proft 3 in. hully, 226-229 to R	01
	Samia Mara B. n. bol.), 7e 1s 1s R	Q4
	Show Boat, Il uminated (14-in.), 367, months	.7
	Stagecoach with horses, 144-145-14f R.map.	
	Breamboar Mess sarns c 9 94 P3 94 R.	1.04
4	Steamsh in Savannah 1 in over ail and Arlancie 6 in 215	
	Attentic 6 th 215	2
	Treating Schooner 17, a but 36 215 Treature Inland" Ship Hespanish (7 in)	- 1
	I sewerce assure on b sandament (, to)	2
,	V hing \$5 p 20 , n 1/12 R	7
4	Whater-Wanderer 1015 th.), 151 to 154	1.0
	Ya. bt Kainhow I , n ha'll 255	.7
	Yacht See Scout 4 in racing 106 107 N	7:
	Yacht 20-in, racing 4f R	di
	RADIO SETS	
	All Wave Portable battery 217 R	54
	Amazeur Short Wave Receive 155	2
	Ameteur Rad o Transmit er 10.1 100	51
	Amy See Three 5 age A in o.F rquen 42	2
	I ve T he Shot Wave AC of DC 227	7
	Full Erit & Headphone Set 4,00	2
	One Tube batte y operated, 203	7.
	Screen Gr d Ser 109	7:
	Short Wave Converter Unit, 197	.2
	FLYING AIRPLANE MODELS	
	Bremen (]unkern, 1-ft), 39-90	- 54
ļ	Nauport XVII. 20-te., 140-787	- ili
	6 E Sa World War Plane, 20-in., 266-249	.54
	Winnie Man. 6-35 - 242 242 243	7:

153 Fourth Avenue, New York head me the bluepoint of the part in an abered.

City and State ... Phrase print your same and address clearly

MODEL OF NORMANDIE

(Continued from page 77)

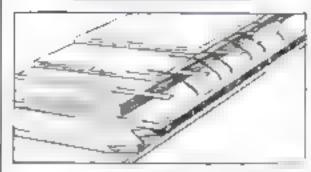




Fig. 5, Lilabouts and two streamlined wentslators, and eketch showing lifeboat supports

will be covered by the funnels. Since the superstructure is wider than the hull, it overhangs 1/16 in, on each tide. Care must be taken to make the overhang even. The funnels may then be glued in position, the second and third being farther apart than the first and second

The masts are finally inserted into boles previously drilled and then bent with pliets at the base into the proper rake

Last of Materials WI TE PINE, BASSWOOD OR BALSA.

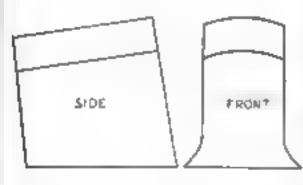
No. of Places	1	11	L.	Fre
-)	1 10	5.5	34	B, C D F and V
3	1 16	3 3	74	N O and L
1	1 (6	419	14	L7 and L2
i	4 B	1 24	24	T' T' and W
1	1 3	33	12	Funnel-

Tr. The remaining pieces are to be cirt from to the cirt from

MINCELLANEOUS

- fish half cound up, reed about 2 to. long for edge is swimmer post-
- 7 to in organies of the s t his stiff wire for davits and maff 1 'C fine uplit barnhou for wonders Plante. 5-in, length of 1 10-in, done low dervick browns. Some piece of thin cardioard for an hore and hatch cover
- Black white red, brown and half paint for our black white red, and bull and min then to make brown;

 *For full-half moriet publicate a block 1 by 7's
- by 24 in for plete A.



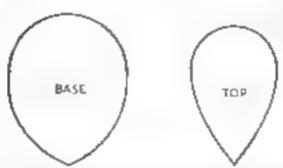


Fig. 6. The funnels are so peculiar that these four views have been drawn full succ

NEW KIND OF MOTOR OIL ENDS STUCK VALVES, **LEAKY PISTON RINGS!**



Prote sludge deposits from plant oil on (A) valves (B) piston rings, causing them to stack and less. Compare with eless values (C) and tress prison rings (D), inbricated with New Pontisoth

FINEST PENNSYLVANIA OIL, REFINED BY NEW PROCESS, NOW

- L. Cuts oil consumption up to 50%
- 2. Seves up to 15% on gesoline
- 3. Cuts valve and piston ring troubles 75 to 90%

ORDINARY motor oils can't stend today's high speeds and temperatures. These oils contain elements that break down under engage heat and cause studge. This collects on valves and rings wastes power, oil and gas.

But now comes New Pennavil, refused by a new solvent process that removes sludgy elements. Result-valve and ring repairs are reduced 75 to 90' 1 . . . there is no sludge to cause valves to stick or rings to leak. Then, too, with studge eliminated, New Pennsoil's tough film is tougherdoesn't burn up—cuts oil consumption up to 50° c. And, because valves and rings work freely, you get better power, speed, pick-up. You mve up to 15% on passing!

New Pennsoil costs nothing extra. Just ask any honded Pennsoil dealer for the correct grade for your car,



"Ab" Jenkius, in his Pieces Acrow, broke 11 paster world's spred seconds with New Penniud.

FAULTY LUBRICATION RUINS MORE CARS THAN SMASH-UPS

Ar least 7 different lubelcants are visit to different parts of your car and Peonsoil dealers, who specialize to the Pennsoil "Safery System" of lubrication are philled in



FOR PRAFETY SYSTEM! CHRRICATION, COOK FOR THIS SIGN

how to apply them Every dealer who d splays this MEN CAR RIVE year car the specul (abricantair needs and save tostly tebut bills later.

THE PENNZOIL COMPANY

Off City Pa Los Angeles, Calif. British American Oil Co., Ltd. Canada

TOUGH-FILM



Months Fran Gratef Gilde a Person No.

This easy test will show you which polish to



Compare Du Pont Polish with any other make

First, polish one half of your car with Du Pont Duco Polish. Second, polish the other half with any other make.

Now you can see why Du Pont Polish is called "Speed Blend." It's easier to use — quicker in action, Makes your car shine brighter and longer. That's why it's the most popular liquid polish you can buy.

TRIAL OFFER—Try
Da Poot Polish at
our expense. Get a
generous sample
biller. Samply sear
out this advers se
e ent, and send it
with your name and
ampression DC 20NC,
Dept S-53. Willingtor, Del his one of
an stamps to cover
portage.



ROOMY Knitting Bag

DESIGNED TO STAND BESIDE CHAIR



The bag, which letes up for carrying is large amough to bold the knitting yarn, and needles

by the present vocate for hunting a convenient keating bag of the type allotrated forms a desirable and always welcome gift. This bag is fastened to a wooder frame mounted on trestle legs so that it can stand on the floor beside a chair It is targe enough to hold a good-sized piece of work, together with long needles and a ball of yarn. The ball remains in the bag while the knitting is being done

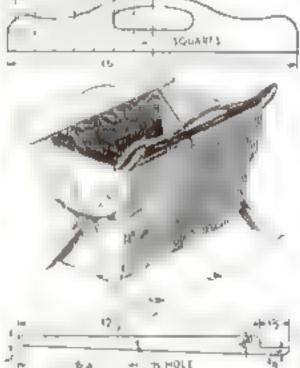
Frame and less are of ½-in, stock. The two pieces for the handles may be saved to shape with a coping saw. Cut the opening for the hand before sawing the outside shape Small holes spaced about 1 in, apart are bored along the lower edges. They should be just large enough to esable a needle to be passed through when the material is sewed to the handles. A 1%-in, brad fastened in a band drill may be used for bornes the holes instead of a regular drill. The head is cut off the brad

and the end filed to a flat chisel

The legs are sawed and planed to shape, and joined with small bolts 614 in. from their lower ends. The handles are fastened to the legs with glue and a couple of small brads

The wooden frame may be stuned and finished with three or lour couts of very thin sheling. The sheller is rubbed down between coats with No. 1/0 steel wool. The last coat may be rubbed with powdered purious stone and crude of, to a smooth, sating finish.

The box is now made and sewed to the handles. It covers the upper part of the less, but their lower ends are put through a slit in the bag just above the point where they are juined

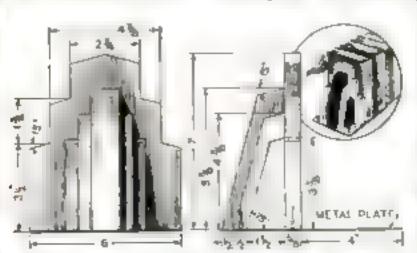


How to Joy out and assemble the four wooden parts. Which are nawed from tom stock

MODERN BOOK ENDS MADE FROM SCRAPS

THESE attractive book ends may be made from any pieces of scrap left over from other jobs. Different kinds of wood may be used in the same book ends

It is recommended first to saw and plane



all the pieces to dimensions. The five small pieces at each end amake then be glaced side to side as a tint. Each unit is smoothed with a plane and giord to the 6 by 7 in, boards. The whole assembly is next placed on a metal plate.

and its outline scratched with a steel point. Each plate is sawed to this shape with a peweler's saw, filed smooth, and lastened with three flattead screws to the wood as shown after which a piece of cloth or felt is glued to its underside. The glue should be applied to the metal and not to the cloth.

The book ends may be finshed as desired. If made from different kinds of wood in such a way as to give a pleasing color contrast, no stain should be applied.—H H.

DURABLE COLLAR HOLDER CUT FROM ONE PIECE



This nest collar holder is cut and formed from spring brass and then thromsum plated

ALTHOUGH homemade, this collar holder equals in appearance and surpasses in durabuity the average commercial article. The writer has used it for the past two years and finds no perceptible loss in gripping power

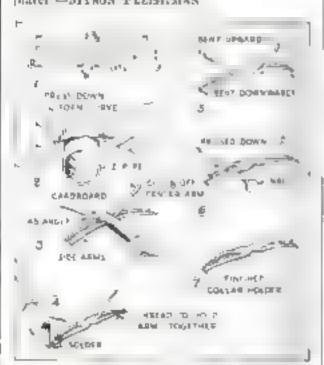
It is made from a piece of 18-gauge spring brass 7/12 in, wide and 236 in. long. Two saw culs are made from both ends of this piece with a jeweler's saw according to the dimensions given in the drawing. The central V-shaped design is their fied.

The metal is bent to the desired curvature by pressing it against a 2-in, pipe. It is then held in the center with a pair of pliers while the central parts between the saw cuts are bent upwards at an angle of about 45 dec Place a piece of curdboard over the metal to prevent the pliers from marring its surface Cut 1/2 in, off the length of each central piece The upraised center arms, as well as the

curved side arms, are now tapered with a file and smoothed with fine emery cloth. The side arms are forced together by wrapping cotton aread around them. When the ends are about 1/16 in apart, they are joined with soft solder The joined side arms are then bent down-wards 14 in from their ends. The upraised center arms are bent upwards 16 in, from the end, as shown in the drawing.

A nail about 1/4 in. In diameter in placed across the side arms and against the center arm. The latter is then bent down over the ned as far as it will go. After the nail has been removed, the center arm is pressed down until its bent end goes into the opening between the joined side arms, Repeat on the other side.

After a final smoothing with emery cloth the coiler holder should be chromium or gold pluted. You can have this work done at a reasonable charge by any professional electromater -Myson Flaishman



Step-by-step sketches showing bow to cut out, bend, solder and fout the holder

IT'S HARD TO BELIEVE THEY ONCE CALLED ME

It's a shame to be

When This Special Quick Way Adds 5 to 15 Pounds...Fast

Astonishing gains with new double tonic. Richest imported browers' ale yeast concentrated 7 times and from added. Gives 5 to 15 pounds in a few weeks

THOUSANDS who were "skinpy" and friendless have gained solid, attractive flosh this new, easy way—in just a few weeks?

Doctors for years have prescribed yeast to build up health. But now, with this new yeast discovery in pleasant little tablets, you can get far greater tonic results than with ordinary yeast-regain heath, and also put on pounds of firm desh-get husky, healthy, good looks — and in a for shorter time

Not only are thousands quickly gaining a fine-looking physique, but also clear, radiant skin, freedom from Indigestion, nervousness and constipution, new pep.

Concentrated 7 times

This amazing new product, Ironized Yeast, is made from specially cultured becween ale ven t imported from Europe - the richest yeast known-which by a new scientific process is now concentrated 7 times - made ? times more powerful.

But that is not all! This marvelous, healthbuilding yeart in then ironwed with 3 kinds of strengthening, energy giving iron.

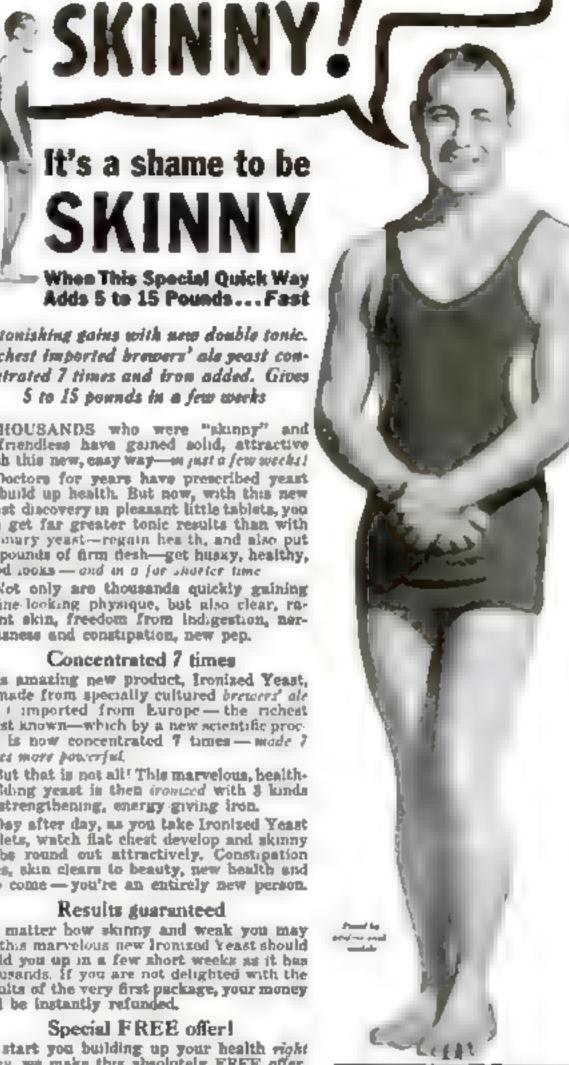
Day after day, as you take Ironized Yeast tablets, watch flat chest develop and skinny hmbs round out attractively. Constipation gres, skin clears to beauty, new bealth and pep come - you're an entirely new person.

Results guaranteed

No matter how skinny and weak you may be, this marvelous new from god Yeast should build you up in a few short weeks as it has thousands. If you are not delighted with the results of the very first package, your money will be instantly refunded.

Special FREE offer!

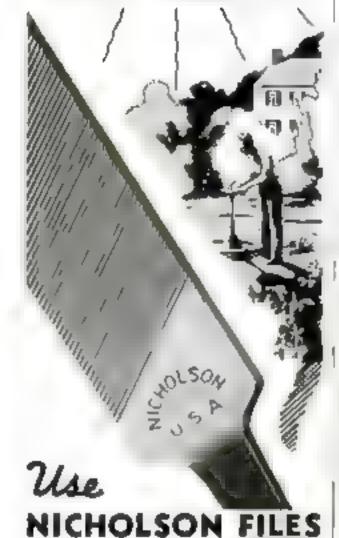
To start you building up your health right group, we make this absolutely FREE offer Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a chipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body," by a well known authority. Remember, resuits are guaranteed with the very first package - or money refunded. Sold by all good druggests. Ironized Yeast Co., Inc., Dept. 457, Atlanta, Ga.



Gains 11 lbs. in 4 weeks

I was in pretty bad shape Had and tired I was afraid I'd lose my job. Irosized Yeast stopped to y const pation and I and no more trouble with headaches. I gamed it has in 4 weeks and feel strong as an ox. thanks to from itself Yeast. — Robert Thempson, Crismbur, ba

MAKE A SUN DIA



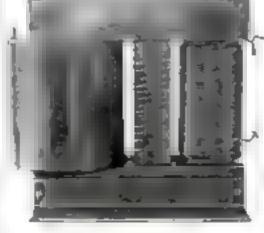
A SUN DIAL for your front yard, or garden, is an excellent number project for the home tool user. Among the necessary tools you will find especially useful are Nicholson Mill Files. Use them for amouthing off the "saw pierced" surface of the metal face of the dial after you have Cut out your pattern

For every outdoor filing need - for sharpening garden tools, refacing golf clubs during the season; for building an arbor seat, for keeping ignition of motor cars and motor boats to shape - you will find Nicholson Files in the right shapes and sizes. Sharp cutting, durable, uniformly high in quality. Sold by hardware stores everywhere at popular prices. Nicholson File Company, Providence, Rhode Island, U. S. A.

Genuine NICHOLSON FILES

BUILDING A 12,000-Volt

Transformer



By KENDALL FORD

O PRODUCE spectacular displays with the high-frequency article of this series (P. S. M., May 15, p. \$21, it should be used with

a transformer having an output of from 10,-000 to 13,000 volts and a capacity of ant less than one kilowatt. The transformer illustrated was designed especially for that codand has sufficient output to energize if to its

full rapacity

Cut 3 2 pieces of transformer from, 2015 in thick to the size shown at hig I and the same number of pieces to the size shown at Fig. 2. If a different thickness is used, cut ranugh to make one stack of each size 5 in high when pressed thosely together. Make a box for stacking the core, 1255 in. long and 25% in. wide. Alternately place the longerpieces of iron in the box until one bull of the total number are so placed. Remove the pieces carefully from the form and tape with friction tape, as shown in Fig. 3. Detailed information on stacking fransformer cores was given in a previous article (P S M, June 31 p 80) Assemble and tape the remaining half of the farge pieces of from Wrap each assembled section of the core with empire cloth, or varnished linea, 71/2 in long and to a thickness of 1/4 in. Place a strip of friction tape, 10 in. long, over the

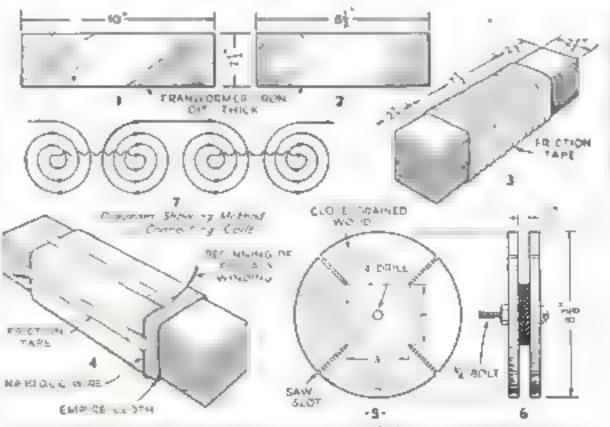


Left A transformer for high-iraquency especiments, Above. Wrapping tapa around a cold of the secondary

empire cloth on each side of the core, allowing such to extend 1½ in, beyond the edge of the empire cluth.

The core is now ready for the primary winding. Beginning 16 in from the odge of the empire cloth, wrap a turn of No. 10 D C. C. wire and fold the end of the friction tape over the wire, as shown at Fig. 4. Wrap the pest turn of wire over the folded portion of tape and continue winding to 34 in. from the edge of the empire cloth at the appointe end of the core. Ford the ends of the tape back over the winding and place four more 10-in, strips of friction tape over the winding. Begin winding the second layer of wire over the first layer and when the first turn is in place, fold back the ends of the tape, as was done with the first turn of the winding. Continue winding as out ned above until a total of 344 turns have been wound upon the core. The thicknesses of ampère cloth may seem to be excusive insulation for a voltage of 110, but its main purpose is to protect the primary from breakdowns due to high-voltage surges from the secondary.

For the second- (Continued on Juge 41)



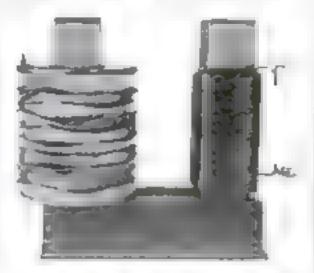
The two stress of transformer from used, how they are taped after being stacked, starting the primary winding, form for winding secondary sections, and how secondary coils are connected.

BUILDING A 12,000-VOLT TRANSFORMER

Continued from page 82)

ary windings it will be necessary to make a wooden winding form, as shown at Figs. 5 and 6. The form consists of two 8½-in, wood disks, with a 3-in, square center secured to one of the risks, as shown in Fig. 5. Close grained wood should be selected for the form, so that there will be no rough edges at the saw slots. The form is held together with a ½-in bolt, the end of which may be placed in a lathe or the chuck of a hand drill for winding. Before beginning to wind a section sectes of small wire about 8 in, long should be placed in the saw glots, and the square center of the form wrapped with several layers of paper, ½ in, wide

In winding the sections of the secondary either No. 29 S. C. E. or No. 12 D. C. C. wire may be used. Approximately 17 lb. of the No. 32 wire or 24 lb. of No. 29 will be required. If the winding form is made to the exact size shows in the drawing, it can merely be wound uptil the wire is up to the



Transformer with ten secondary sections in place tendy to receive remaining core pieces

top of the form without counting the turns. Approximately \$8,000 turns of wire will be required for the whole secondary and since there are to be fen sections. \$1,000 turns will be wound on each section.

The latte may be wound in a lathe or the chuck of a hand drul, but no attempt about the made to hurry since several hundred turns thay be lost by aneven winding. After each section is wound the tie wires should be tied around the coil and the form taken apart. The strip of paper around the center of the form may now be removed and the coil carefully lifted away from the form. Let the coil sould be not paraffer for several minutes, then carefully remove it and place it on a sheet of paper on a flat surface. When the paraffin is hard, remove the paper and the wires, and tape the section with linen tape, allowing the tape to lap one half its wid of

Hring the leads out of the coil between t ris of the tage so that noe lead will be on the inside dimeter of the rot and one on the outside each lead being in a vertical line with the other. Mark an arrow on the tage near each lead to indicate the direction of the winding. After the roll is taged, it will be somewhat thicker than the form upon which it was wound, due to the paraffin that was absorbed in the insulation. All owance for this increase was made in calculating the core space.

Cut two circular pieces of fiber 1/4 in thick and 8 in. In diameter, and cut a hole 3 in. square in the tenter of each. These pieces are to serve as end pieces and terminal supports. Drill a 5 32 in hole in each for the terminal screw near the outside edge. Cut 30 pieces of empire cloth the same size and shape as the fiber end pieces, and enough pieces of cardboard to make. Communed on page 81.



NEVER TOOK A LESSON FROM A TEACHER

-yet Bab is the eney of his music leving friends

The second fears of they are to the time as the analysis of the time as the analysis of the time as th

New Easy Method

The deat there we by high your of here was be even to be a most be east only for the most of the same of the most of the most



DEMONSTRATION LESSON PREES

Fig. of for Epoc demonstration to one imperior with tage free backles and the class of the desired proof that will admind any to the class of the Walter to the particular terms. U. S. School of Manks, 27 Branco-let, Side .



NEW

HANDBOOKS AT BARGAIN PRICE

Think of it—only \$1.00 each for these NEW cloth bound Manuals. This low price is temporary, we may have to raise it later. Not just books of WORDS, but diagrams, drawings, directions, showing each stage of the job. Full-sized books, about 200 pages each. Sold separately—take your choice.

Auto Kinha Car owners and service man's handbook of working disgrams, pictures, instructions, now reprinted in book form from Popular Science. The best ideas from among thousands. Will save many dollars and keep your car in tip top shape through many jobs you can now do easily. Cloth bound \$1.00.

Wonders Through The Microscope Turn an inexpensive microscope on hundreds of specimers with
in a stone's throw of your front door
and you step off into a new world of
wonders. Complete Manual for and
teurs. How to use equipment, secure
and preserve specimens, take photo
nicrographs, etc. Numerous illustrations. Full cloth bound \$1.00.

Fix it Yourself A new edition of a famous book, showing with diagrams and directions, how to fix and repeat furniture, electric autlets, windows, doors, leaky pipes, floor boards, chimneys, boilers, weather proofing, painting and hundreds of other construction and repeat jobs. Full cloth bound \$1.00.

Astronomy For Ameteurs E asy ways to know the heavens with siraple, home-made equipment, charts and guides. Opens up new worlds of wonderment—a gloriously fuscinating and instructive hobby for the whole family. Many illustrations. Full cloth bound \$1.00.

Madie Experimenter and Builder Latest long and short wave facts and diagrams that will suggest improvements to make and new sets to build Trouble shooting, How to service and repair, etc. Cloth bound 256 pages, \$2.00. Book Of Formulas For homehold, shop, laboratory. Formulas, recipes, methods and secret processes. Make your own beverages, glues, cements, rickners, polishes, enamels, points, conmettes, dyes, inks, toothpastes, soops, silver and mekel plats, metal alloys, photo chemicals, oils, lubricants—and scores of articles for home use or for founding your own business through making and selling. Full cloth bound \$1.00.

The Hema Chemiet How to set up and operate an inexpensive home laboratory with odds and ende of material available in every home. Many thriling, practical, useful experiments and tests, entertaining, instructive valuable, pointing the way to research and new discoveries. Many diagrams and illustrations. Pull cloth bound \$1.00.

Manual Of Ship Model Making How to make any model. Here are clearly diagramed the many short cuts, kinks, and time saving methods of experts. Complete plans and specifications for a gorgeous gaileon, clipper ship, etc. Almost up illustrations, Full cloth bound \$4,00.

Woodworker's Turning and Joining Manual The simplest, most practical ways to make end tables, chairs, benebes, highboys, book-racks, cabinets, all kinds of furniture, in your spare time. A revelation of simplicity and helpfulness. Many illustrations. Full cloth bound \$1.50.

Making Money With Your Camera How to put your hobby in the money making class. Salable pictures to take for publication, or for sale to manufacturers—how and where to sell, etc. Cloth bound 250 pages, \$2.00,

How To Build Cobins, Hunting and Fishing Ledges, Sungaious Deagrams, plans and instructions unyone can follow. Build st yourself! Now you can put up a fine cabut or small bungalow, without previous expenence. How to estimate the material, cut, join, assemble and finish everything. Illustrated with plans and diagrams of most popular cabus and bungalows. Full cloth bound 256 pages, \$1.00.

SEND NO Money

When the books arrive pay the price shows per book plue a few cents postage. Money refunded no books returned within 5 days of receipt.

POPULAR SCIENCE MONTHLY, 353 Fourth Ave., New York, N. Y.

Send me the Manuals checked be to

Furmain \$1.00 Microsange \$1.00 Auty Wake \$1.00 House Charaint \$1.00 Maj Model \$1,60 Woodsvelate \$1,60 Fin it \$1.60 Astronomy \$1,00 Resto \$2.00 Canadra \$2.00 Çabbay \$2.00

When the books arrive I will pay the postume price shows beside each books arrive plays a few courts normals. You see to refund what I has a paid if I return the books within five days of their receipt. P.S. 7.35

NAME

ADDRESS

CITY

BUILDING A 12,000-VOLT TRANSFORMER

(Continued from page 83.

a stack ½ in, high, Join the two taped sections of core together at one end with the short pieces of transformer iron, shown in Fig. 2. Clamp the core together with pieces of angle trop and ½ in, bolts. The core is now ready for the secondary sections

Place a fiber end piece over the core so that the terminal will be on the outside. Since it is not advisable to let the secondary sections come any closer than 1/4 in, from the end of the empare cloth on the core, it wil. be necessary to place a number of the cardboard spacers next to the fiber end pieces before placing the first section. The secondary sections should be so arranged on the core that the winding of each will be in an opposite direction to that of the preceding coil. After the first con as in place four secplace another coll. Connect the inside of the first coil to the inside of the second coil, making the connection as short as possible, and solder with rossn as a flux. Place the connecnon between the two layers of empire cloth and press the coil into place,

PLACE the third coil on the core so that the winding is opposite to the second coil and connect the top wire with the top of the second coil. Connect the remaining coils as outlined above. The coil connections are shown at Fig 7. It will be seen that with the coils arranged alternately on the core, with reference to the direction of the windings, the current will flow in one direction around the core.

After all of the cots are in place and conocted, put the cardboard spacers and fiber end piece over the core and insert the remaining core pieces. One photograph shows the transferreer with the secondary sections in place, ready to receive the remaining core pieces. Clamp the end of the core together with pieces of flat iron and \$\(\xi\)-in bolts. Conoct the two ends of the secondary code to terminal screws and cover the whole secondary with a piece of thin fiber or cardboard

In order to prevent arcing at the spork gap and increase the efficiency of the transformer, the design includes a magnetic leakage occurs, which is placed between the primary and secondary as shown in a photograph. The section consists of enough pieces of transformer iron, 2 by 7½ in., to make a stack 2½ in. high, securely taped together. The section is made removable so that the builder can note the effect with and without the section in place. To avoid breaking down the insulation, it is always advisable to provide a temporary gap across the secondary, not greater than 3½ in., when testing the transformer

ZING A BLACK COLOR

Agricus of sinc can be given a dense, dead-black color by applying a saturated so-batton of copper sulphate. Thoroughly clean the anc first. The black will be dutable after it is dry. This method is particularly useful for blacking etched sinc tame plates. Poish the blacking from the letters, and wax the background if you wish it to have a shiny, instead of dead-black, appearance.—C. L.

TAPE PROTECTS INSULATION FROM HEAT OF BLOWTORLH

Where attaching soldering lugs to wires and cables with a blowterth, the insulation nearest the end of the tond-ctor can be protected from burning by first serving the end of the conductor with three or four layers of friction tape for a length of about 2 in.—L. N. G.

KNOT-WORK SLIPPERS FOR MANY USES

(Continued from page 65)



Fig. 6. The work to held with pushpins on each aids while the conter know are tied

which will hold the statching securely, is thick, waterproof casein glue. Spread this in a thin film on the bottom of each sole, making sure that each stitch becomes soaked with it Press each sole into contact with a piece of light leather, and weigh them down for twenty-four hours until the glue has completely set. The excess leather is then trimmed off with scissom or a meor blade.

If you wish cool outdoor shoes that will stand more than the usual wear, use lightweight leather for the soies, instead of sponge rubber. After the uppers are knotted, cement a pair of ten-cent composition half soles in place, and attach a pair of rubber beets.

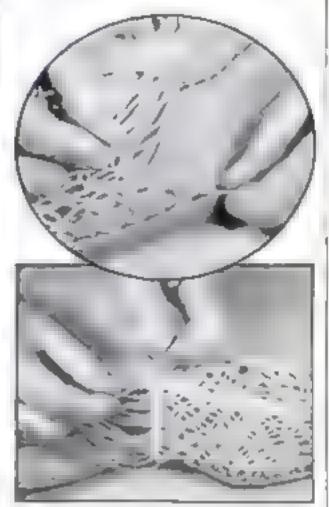


Fig 7 The upper photo shows how the sides at the appere are anchoted to the stitching after the twenty cords have all been knotted The oppers are finished clower view) with a row of ha.f h iches made with the loose cords over a single cord brought across the instep

Substitutions are requested to notify at of change of address four weeks in advance of the next publication date



otorcyclina

BOY, oh boy! What a thrill when you "take off" astride this plane-on-wheels. Kack her over — throw in the tlutch - give her the gas and she leaps to your command. You are off like a finh - rooming along out in front, never to be headed.

There's a quick way to find out about the new thrids that await you with a 1935 Harley Davidson. See your nearby dealer now. Ask him to take you for a apin, His Easy Pay plans will make it

easy to own one. And don't forget to send in the coupus.

POCKET CHART AIDS IN WEATHER FORECASTING

(Continued from page 61)

back and make a heavy paper envelope in which to keep the chart

Take daily readings of the becometer to know whether it is rising or falling, and note in a general way how the wind blows.

To use the chart, turn the disk until the proper wind-direction and becometer indications show in the two upper windows. In the lower window numbers appear. Choose the one suiting the conditions, and read on the back the forecast corresponding to it.

For Instance, suppose that the wind sets in between southwest and northwest, and the barometer, rusing rapidly stands between 30.1 and 30.2 in. No 2 turns up "Fair, followed within 2 days by min."

Suppose, again, that the wind is from east to northeast, with the harometer at 30.1 (or above, as indicated by the upward-pointing arrow in the chart), and falling slowly This reads as No. 9.

By taking daily weather notes you can look discover the important variations of these rules peculiar to your locality. If you live on the west coast, the meaning of wind and barometer readings will be somewhat different from that of readings taken on platests east of the Rocky Mountains. Little rain or snow is to be expected within a lowpressure area over Idaho where the winds, purged of moisture by the mountains, have blown over rather dry areas, although the wind-barometer sizes are much the same as those noticed when the storm is west of the Cascades, fresh from a trip over the Pacific Ocean. When this same center of disturbance has moved over the Manuappi Valley, wants

FORECASTS

1. Fair, with alight temperature changes, for I to 2 days.

2. Past followed within 2 days by rain.

1. Continued fur, with no decided temperature change

4 Blowly rising pemperature and fair for 2 days.

5. State within 24 hours.

4. Wind increasing in force, with rain. within 12 to 24 bours

7 Re n in 12 to it hours.

1. Increasing wind, and rate within 12

I. In summer, with light winds, rain may not fall for several days. In wister, tain within 24 hours.

10. In nummer rain probable within 12 to 24 hours. In winter rain or snow with increasing winds, will often set to when the batometer begins to fall and the wind arts in from the RE

Il Rain will contage 1 to 2 days

17 Baro. with high wind, to lowed, within 16 boncs, by clearing, and in winter by colder

13. Clearing within a few bours, and fair for neveral days.

14 Severe storm imminent, followed, within 24 bours, by clearing, and in winter, by colder

15 Severe portheast gale and heavy prec preation in winter beavy snow, followed by a cold wave.

16. Clearing and colder.

lader with moisture from the Great Lakes and the central valleys spiral toward it, and rainfall begons to increase in the castern side.

---- MAIL THIS COUPON ----Harley-Davidson Motor Co., Dept. PS,

Milwaukee, A isconnit. Interested in memorcycling. Send il-lustrated literature. Postage stamp is enclosed to cover smalling cost.

Address.

My age to 18 14 years in 16 treety 134 years and up, 1 under 16 years. Cheek year are group

New Motor-Driven DELTA SHOP TOOLS



distance the new Tobles date y to be to be being the wife to be to be being the work and the work air over the world Idea or both y work. hower thre hoter matche, or production werk. The bellation includes Obstular Saws, Double Propose, Band Saws, Lather, Scrub Saws, Jountary, and full line of controllers. Principle of the of expensioned, Priced with the the work of all Write for complete Dails calabag.

Write for

DELTA MFG. COMPANY, CATALOG! Dest. E-78 Blivelyer, Wies.



Bit includes afform a select for included ing the transition of th choice Flying c and. Car ettl deep or Reports Collect Urder sept. Crisius He.

NOY HANCOCK

Build of madel like this, 2000, Imphaton, Perisonals, St.,



CAMERAS AND SUPPLIES BIG BARGAIN BOOK

Offers introduction were howh to say.

Ingo up accepts Estrage and his relative Mills or Music A of Missouriate and Westber Instruments at equally an arising two process. A new teams to discuss the say complete. The Daranta Book Wests for your copy of his Mills, thous wise.

CENTRAL CAMERA CO. Set. 1889 \$34 S. Websch free.



Have true ever taken the avoid trust and triveted happy under higher it absolute higher without The higher trust and the Third happy that the trust and trivet in the triveter in the triveter

DEALERS WANTED!

Bex 246-67. MILL WED. CO.,

WARREN, ONL

THE NATIONAL HOMEWORKSHOP GUILD

Continued years page by,

the itom had to be done between the bars of the case, and he left the figure attached to several bars at the year so that it would not shift around. The completed mece is probably the most elaborate variation of the old and well-known ball-and-cage whitting stant that has ever been made

That Mr. Stewark is equally good on straight cabinetmaking is shown by his proneer calainet, illustrated on this page. The carved panels on the door show, first, a buftale hant by Indians, second, a covered wagon; and third, a farm on the edge of the prairie. In the circular panel at the lop is a woman spinning, to represent the early proneer home. In model making, Mr Stenwick at similarly professent. His Viking ship, atmost entirely carved from solid wood instead of being built up, was regarded by the judges as one of the most decorative models in the display. He sums up his home workshop philosophy very simply; "There is real satisfactson an tackling a hard job and making a go of it. That is why I have kept at it all these years."

The following new clubs have been granted charters since the June baue was published: Le-Roy Homeworkshop Club, LeRoy, N. Y. Niagara Homework shop Club, Nugara Falls, N. Y I West. St. Louis Homeworkshop Club, West St. Louis, Mo.; Crown City Homecraft Club, Passdena, Calif: Freeport Craftiman's Guild, Freeport, N. Y.; Ottomwa

Craft Club, Ottumwa, Iowa.

Several local clubs have sent in unusually interesting photographs of their local exhibitions. These are being retained for publication in soun in space it available.

Clubs looking for a project that will have some civic value may be able to make use of a suggestion offered by a trader in St Paul. Minn. "Would it not be a good idea." he wrote, "if one or more of the clubs would make up a set of ship models, such as those in your Popular Science Model-of-the Month series, and present them as a permanent exhibit to the town library or one of the schools? A small bruts plate with each exhibit could give credit to the club and, if desired, the individua, members who contributed their work,"

Corved Pioneer cobinet by O Stenwich of Red Wing. Misn.-second price. for hund-made farm ura

> CLUB ACTIVITIES Germer Laurence (Man.) Homework thop Club. At a large exhibition held in a hardware store, the Popular Science Craft work Medal and a purchase order for tools were awarded to Ernest Dugarden for brass turnings, Robert Zeiner won see-

and prize for an initial fern stand, and William Hilbert third prize for an infaid amnling stand. . . . The idea of holding an exhibition for all the clubs in New England is gaining strength.

Newcastle (Calif.) Homeworkshop Club Prizes were awarded as follows at a club exlubit given in the window of an Auburn lumber company: first, P F Hirsch, for a duck pool, second, Mr. Harsch, for the minouetres or four wild horses, third, Emile Saindana, for a garden goose

Mount Vernon (N. Y.) Hameworkskap Club. Herman Hjorth, a regular contributor to Popular Science Monthey, recently gave a wood-turning demonstration before the club at the Edwon High School Aspert Constantime also gave a (Continued on Juge 8;



Brase and capper Jewel canket by W. Sovich.

of Chicago-second prize in decorative metal.

Some of the numerous models. Hear the center can be seen the steam threshing engine model of Edwin J. Davis, Rockford, Ill., which was second prize for model making

HOMEWORKSHOP GUILD

(Constnued from page 86)

talk on veneers and how to use them. Yakima (Wash.) Howeveraft Ctab. The second annual exhibit and contest sponsored by the Yakima Club was held in the display room of the local power and light company. More than 250 articles were entered. The Popular Science Craftwork Medal and the grand price a scroll saw, were won by George Raichie. His entry was a tea wagon. There were forty-five prices in all.

Capital Homecraft Ctub, Washington, D. C. A summer exhibition will be held in a store window in the business section of Washington. . . . An exchange and barier department has been estub-shed under the management of C. T. Kingsbury, the member

who suggested the idea

Springfield (Mair.) Homecraft Club. A large, wet astended exhibition was held in the Junior Achievement Building C. A. Denham was awarded the Popular Science Craftwork Medal for a hand-curved pisque of Abraham Lincoln, Second prize for the best exhibit in the show went to Walter Preshe for a samboat model.

Lincoln (Nebr.) Hometspekikop Club. At the second annual exhibition and contest, Robert Dyer won the local sweepstakes prize

Topeko (Kans.) Homeworkshop Club George F. Gladfelter is about to start a new show-card class of twenty members. . . . A firm furnished by Batech & Lomb was shown at a recent meeting of the photography class, which was attended by more than seventyfive members and friends. . . . Plans are beng formed for starting a class in radio

Manchester (N B) Hometourhskap Club More than 121 members and guests attended a recent demonstration at a local hotel. A complete set of home-workshop machinery was on display, and demonstrations in lathe work were given by W B. Mclivie. Frank R. Smith, of the manual training department at Central High School, gave a talk on furniture and furniture design. . . . Within three months the club has grown from therty-six to righ y-three memoers

Allerta (Ge.) Homecraft Club. To aid in a membership drive, the club has had large posters painted and placed in a number of stores setting hardware, paint, and machinery. Cards are provided for passers by to fill out and drop in a box near each poster

San Diego (Calif.) Hometraft Club. Theodore T Clemesha, who won ant prize for Vettering and shlaying and second prize for furniture made with power driven tools in the first National Exhibit on of the Guild, has been giving to ke to the club members on design, woodwork, and furniture finishing. . . . The club will hold an exhibition in June

Chicago (III) Premier Homeworkshop Cinb. Since this club won the grand sweep-stake prize at the National Exhibition, the meetings have been crowded with prospective members and visitors. Officers of many Chicago hobby clubs were present at one receing. New quarters will be required immediately, and a centrally located suditorium is under consideration.

Dunktrh (N Y.) Homeworkshop Club. A late spring exhibit was held in a local bard-ware store

Bittings (Mont.) Homeworkshop Club. In the local Festival of Arts, sponsored by the Women's Club of Billings, the home workshop club was well represented and members won a number of prizes.

Brunsteach (Me.) Homeworkshop Clab. A demonstration of chip carving was given at a recent incetting by Warren Raynes of Yar-mouth.

Three Rivers Home Workshop, Three Rivers, P. Q., Canada. A one-member exhibition of traftwork is held at the close of each meeting.



If you like Popular Science Montelly why not peer the word along to your friends.

When an article in this magazine strikes you as being unusually good, tell your friends to get a copy at the newsstand, and read it.







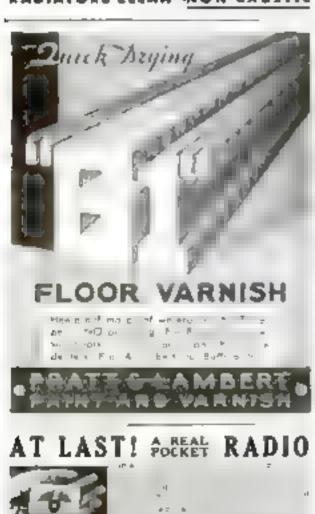
A DIRTY or clogged radiator overheats the motor, robs power, wastes money it's unnecessary. Sam-Plant remerees cust and scale from radiators. Not causes, Cannot harm stammans cylinder-heads or cooling system. You can use it. in a few enimites for a few cents. Simple directions are on the can-

Clean your reductor twee a year with Sant Flush Sant Flush Sant Flush is used in thousands of homes to clean todet broks. Sold by groerey, deug, and hardware stores Products Ca., Canton, Olso,



Sani-Flush

CLEAN-NON-CAUSTIC



TINYTONE RADIO CO DIM

New Kit Contains Materials for

Sea Captain











HERE is something new in construction that contains materials for whittling a quaint and colorful wooden figure of an old sea captain. Skipper Sam'l Anyone. can do this type of work successfully. It is necessary only to follow the sample step-bystep instructions and drawings are aided in the kil. No previous expenence in whittling or carving is required.

The skipper stands 51/3 in high. To give you a good start, each kit contains two blocks of the correct size. These are of specially

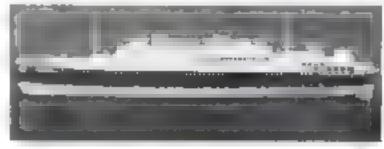
selected softwood and have been sawed to the approximate shape Two blocks are given so that you can practice on one. If you are reasonably careful, the first block will turn out well, and you can get two good figures out of the k ! The necessary parnts are tocluded. The price is only \$1.50. presignant

Another new kit contains materrals for building a 41 4m model of a United States destroyer the famous Prestot. This is one of our standard ship models. and the kit has been prepared in response to many requests. The ofts are cut to shape and everything is provided, including four brass stacks, two anchors, belaying pins, brass bell, two flags, two propellers, and shalts.

Other evailable lists are described in the following list.

STANDARD SHIP MODEL KITS

A. Whaling Ship B'enderer, 1014 in ... \$6 00* AA. Same with help b'ts sawed. 7 40* D. Spanish galleon, 24-in. 6-45* DD. Same with bull alocks shapes in 95* E. Battleship U.S.S. 7 van 1 1 6 95* EE. Same with hall he to saved G. Elizabethan ga icon Revenge. Son 6 "50 GG Same with he blocks shaped 7.25% LL. Same with bull Mits sawed 8 454 Q. Privateer Suntente, 17 3 die ber wich lalts sound to shape V Chipper Sar regar n he Sa half with lifts sawed to shape Y. Tracking achooser, three-masted, 17 , n. aS. U. 5. Destroyer Prosper. M. pin, hall, with lifts sawed can be made either a decurstive or a working model...



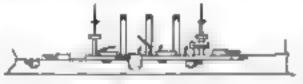
KIT F-Materia's for 12-an model of Manhattag



XIT H-U.S.S. Indianapolis, with partly shaped bull



SIMPLIFIED SHIP MODEL KITS Crainer P.S.S. Indianapolis, 12-in, 150 Chipper ship Sea 31 feet, 13-in, 1 50 MODEL OF THE MONTH KITS M. Aircraft carrier Socaloge, 18-in.... 1.80 N. Four U.S. destroyers, such 554 in. 75 O. Lover S. S. St. Lower 1 n. 100 P Cap with Karathan, 75yan. R. I S are set To delite 1 1, in 100 S - > So grouph chirst steamship to cross n and h m Mittelete bien A maritie 2 t we models in one k .) T . 5.5. Brooklen aemored trusser in Spanish American War, 8-in



XIT T-U. b. S. Brooklyn

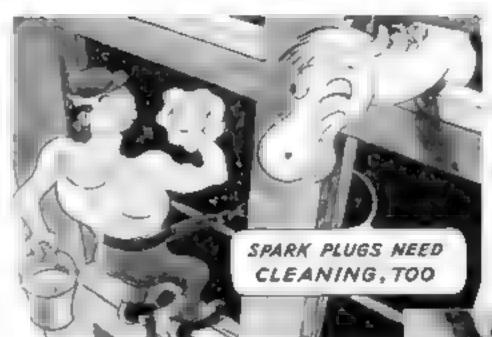
	If spanishe, the ship in "Treasure I	
land."	7-fittingering and the colors are considered to the colors and the colors are considered to the colors and the colors are colors are colors are colors and the colors are colors are colors are colors and the colors are colors are colors are colors are colors and the colors are colors	50
X	5 6 day ordina , is 10	06
Z. }	f M.S. Bounty, 11 Vi in 1	
z MI.	Show leat, illuminated, 14-in 1:	56

MISCELLANEOUS

No. 4. Solid mahagany book trough 1.1, in hope 9., in wide and 9. In high over all Ready to assemble and war a mended. 5.5°

No. 5. Solid rock maste hang or wall tack with one drawer, 19 5 in wide 5 , in high Repriy to passemble and stain included 5. 5

Popular Science Monthly, 355 Fourth Avenue, New Yo	rh. 26. Y
Please send me An	198
which I include 5 or sen-	d C. O. D. Ch.
\ame	
Address	
City Sans	
City State.	
Rentil by intricy under check mail. No kits selling for less th	or majetreed
be sent C C. D This offer is	trade only in
the Lorted States.	ALLEGA COM CP COM







Before Cleaning



After Cleaning

Don't let DIRTY SPARK PLUGS STEAL YOUR GAS! . . . Have your plugs CLEANED by the AC Method

The men who designed your car will tell you that easty, carbon-covered, and Oxide Coated spark plugs rob you of as much as I gallon of gazolme in every 10 you buy. The quick, sure remedy is to let a Registered AC Spark Plug Cleaning Station clean your plugs in the AC Cleaning Machine. Replace worn plugs with new ACs, the Quality Spark Plugs—NOW 60c.

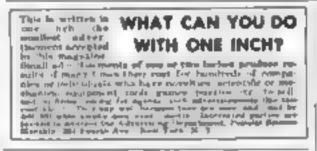
AC SPARK PLUG COMPANY

Plint, Michigan

St. Catherines, Onterio

Plugs for Canadian market—75c—made at\$1.Cathorines, Ontaria









FREE RADICATATOR

Write for the highest all page establish the tooling Builtbuppin Colds. Partial with Built I not Own Built Built, see World Wide built. Builts had Auta Railing Behick Systems and elemands of pasts at tower posters. Write now?

ALUED RADIO CORPORATION

MAKE IT... FLY IT!



wake this New Model ro LAST with strong, quick-drying, easy-to-use Dn Pont Duco Cement. Favorito with model builders everywhere. Send green carton or red disc from 25c tube for free working plans. DU PONT, Dept. A-1, Wilmington, Delaware.

TRANSPARENT-WATERPROOF

DUCO Household CEMENT

HOME OWNERS:- This was written for you and is sent



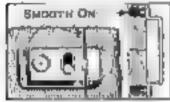
O your own simple home auto and motorboat repairing and be independent of out side repair men You will avoid delays, save much money, and have the sa isfaction of knowing that the work is well done

The booklet contains clear diagrams and directions for correct procedure for hundreds of common jobs, and enables any home worker to get dependable results, easily, on any of the

Stopping leaks in pipes, heaters, boilers, tanks, radiators, air ducts, smoke pipes, pails, etc. at connections, seams, cracks, rivets or holes.

Tightening or anchoring loose hinges, locks, handles, screws, bolts, nuts, bases. stems, tops, cast-

ers, etc. Making waterproof joints at skyaghts 200 cracks and flash-



Tightening been lecits

ng Making wet cellars dry from the inside, making concrete floors bard, water and oil proof, and non-dusting, making masonry walls waterproof.

On the care-Stopping leaks in the radiator, at hose connections, or in oil and problem hnes, patching cracked water jackets, crank, gear and differential cases, taghtening loose zivets, mad guards, lemp standards, hub caps

and labricator connections, loose moulding screws, etc.

Smorth - On Iron ce. ment with which this work is done is applied without heat, without special tools, and so canly and inexpensively that ball a dollar to half a handred dollars is saved in each instance



Alteching pheires to uncrate

Smooth-On has been widely used in industrial work for over 35 years and its me is standard practice by power plant enmocers and repair men-

Get the booklet by making the coupon and buy Smooth-On No. 1 in

7 mz. 1 lb. or 5 lb. can from your hardware store or if necessary from us.

SMOOTH-ON MFG. CO., Dept 50 #14 Communipsw Ave , Jersey City, N. J.

Please send the free Smooth-On Report Book

Vame Address 7. 15



SKIPPER SAM'L—A WHITTLED FIGURE

(Continued from page 63)

outside the arms down to the elbows, Now saw up the outside of each leg almost to the hotthat is, within about (n) Then stop and saw up the fronts of his trousers legs until you meet the saw cut which marks the hottom of his coal Fraish the side cuts, and both less are

Trum up the sides of the coat to the cuffs, and distant (that avoids danger of splitting) from his elbows to his ruffs. Cut nway a little at the bottom of the coat as you see in the side view of Fg 14 Now all that remains to

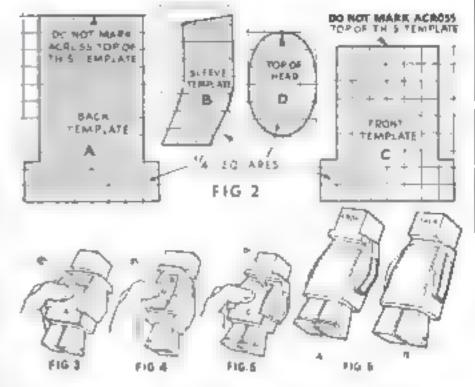
be done is to slope Sam'l's chest. Measure down 134 in from the point of the chin, and from this horizontal line sketch a liberal curve up each side to the inside end of the saw cut marking the chin. Cut away the wood outside this line with keafe or saw, and your timshed blank should look like Fig. 1B

You'll see from Fig. 1C that we need a few more patterns. These patterns or templates are shown in Fig. 2. Lay them out on thin cardboard and cut them out accurately with scimors. Then take back template A, line it up at bottom and sides with the skipper's coat, and mark along the sides as in Fig. 3. This gives you the line joining his arms and body Place and trace the sloeve template B on each arm to turn, hinog up the bottom with the bottom of the cuff and setting the back edge (or the ebow) in about 1/2 in, from the back of the block, as in Fig. 4, Nest align template C on the front of the block and draw up each side as in Fig. 3 to mark the line between arms and body

Now sharpen your knife point and acore deeply along the template times you've just drawn. Keep forcing the knife point down and cutting away the little outer sections of wood

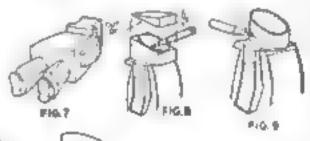
until your block looks like Figs. 6A and oB. This leaves the arms roughly shaped and standing out from the body (see also Figs. 7 to 10)

Let's start now on shoes and trousers. Study Fig 7 curefully first Fig 10 with show you how the shoes look Nick out the heels and round them off



in back. Round off the boant toe and slope the anstep of each shoe. Cut out a saver of wood all around each shoe to show the joint of sole and upper Then take off the rough corners on each trousers leg, making a rough octagonal section tapering from the shoes toward the cost bottom. Cut from the shoes lowerd the cost to avoid sputting

Now measure down 3 n. from the top in back of the block which is to become the skippera head. Draw a horizontili ne perosa the back of the brock and diagona, times on each side to the top of the black at the front, as in Fig. 5. Cut this off Put oval template D in place and pencil around it. Spitt off the outer corners to round the head as in Fig. 9. Shape the shoulders roughly as in Figs. 10A and 10B. Draw a line all around the head oval 1/2 in. down from the top, as in Fig. 9. This line marks the joining of cap and face, so

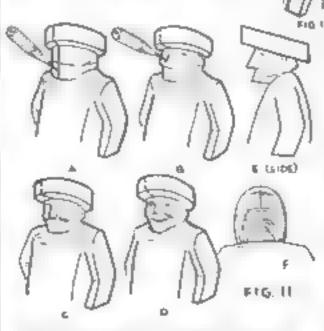


F1G 10-B

with kinte or small saw cut in about 1/4 in, deep all around it Now split off the wood from below all around so that the block looks like Fig. 11A Your Orst step in whit-

tling a face la to locate the nose. Draw a vertical line squarely down the front from the peak of the cap to the point of the chin. Measure down 1/8 in. from the joining of face and cap, and score 3/16 in, deep straight across the face on this line. This marks the tip of the nose. Now cut diagonally in from the point of the chin to the bottom of the scoring cut. Cut away the wood from the tip of the bose diagonally to the point between face and cap at the same anele. The face will now look like Fig. 11E, with proper chin and nose slants.

Study Fig. 11F closely to fix the angles of thin, cheeks, and eyes before you make any more ruts. Mark a triangle for the nose as in Fig. 1.8 then cut away at each side as up. F ps. 11B 1.C, and .'A, about 16 in deep. Now outline the cheek bones by cutting a line 1/16 in deep, sloping downward each side of the nose (see Figs. 1)C and 12A), Cut up from the point of (Continued on page or)



When the body has been sweghly blocked out. the head and features are shaped as shown

SKIPPER SAM'L-A WHITTLED FIGURE

(Continued from page 90)

the jaw to meet this line, and cut along each side of the face to form the jawbone, but don't cut up so far that you remove wood you'll need later for the ears. Cut a shallow slit for Sam'l's mouth squarely across the face (or tilting up a little at the corners, depending on how much grin you want him to have) and about 1/16 in, below the nose.

The eyes are started with notches as in Fig. 12B. They are about 1/2 in, deep and down



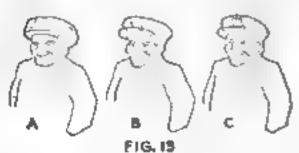
The eyes are started by cutting two notches then thin waters are removed to form sysballs

about 1/4 in from the joint between face and cap. They start at the bridge of the nose and are drepest well out at the sides of the head. If you want to, cut out thin wafers as in Fig. 1.1 to form eyeballs, and make each pupil by cutting out a tiny triangle as in Fig. 1.2D, otherwise merely flatten out the base of the eye socket, then cut a slit like the mouth slit across it. Dig a little hole at the modific for the eyeball

Next shape the cap as in Figs. 15A, 14B, and 14C, sloping in toward the head at the sides and back, and cutting in carefully above the cap visor in front. If you're not careful, you'll split off the cross-grained visor, Shape the ears as in Fig. 14, and cut away the wood at the temples below the shaper's conservative sideburns. Unt in at the back of his neck as in Fig. 14 and roughen or groove the wood back there to resemble hair. Form the hot strap, side buttons, and cap emblem carefully by shaving away the wood around them—these are distinctive parts of a seaman's cap.

Now draw on lapels and coat collar, lapel buttonboles, color and tie, as in Fig. 2C. Score deeply along these lines, and shave the wood away outside them so they stand out Lower the shoulders a little by cutting away outside the collar and cut them back a little to show the lapels. Now round up the whole figure, shaping up each part carefully accord-ing to Figs. IC and 15 Sheeve creases are just three notches all the inner edge of the sleeve inside the elbow-see Fig. 15. Score the line where the coat laps to button, and round off the coat down to the joint between coat and suceves. Don't be too careful-a few broad kmie cuts will make your skipper distinctive. Now mark the button positions, drill holes, glue in ends of kitchen matches, and cut them of thort If you want the pea-jacket to be strictly "regulation," use our buttons instead OI TEME

Don't use sandpaper on the slopper, he's a



Here are the cuts required to shape the cap. He careful not to split or damage the visor

hard-bitten scalarin' man, and sharp angles only accentuate his character. Any paint you have—oils, enamel, lecquer, or even water colors—will do. Make SamT's shoes, cost, cap visor, emblem, and strap black, and his trousers and crown of cap white, as In Fig. 1C. His face should be a healthy flesh color with a dash of color at the cheek bones, nose up, and perhaps thus up. Hair and eyebrows are white, of course Pupils of the eyes are black with a short white line at the left-hand ade of each (but don't put both isside or both

outside, or the skipper will look crosseyed) Better give each part two or three couts, and allow plenty of dryog time between Touch up the cap ornament and visor with gold (the ornament should be



crossed anchors, if you wish to be exact)—and there's Skipper Sam'i, genial senfarin

rean?

Perhaps you d like to try some other expressions, other poses, or even other figures. Go to it! You'll find that a touch of your knife or paintbrush will change facial expressions almost miraculously. You can make the old salt smile, gris, frown, hugh, even weep by judicious combinations of line and color. You can give him a close-clipped white beard, stick a pipe between his lips, or provide a cigar. You can change the pottern slightly and have him sitting down, bearing over, hobbling with a stick. Or change his cap to a bounet or shawl, his trousers to a bulging skirt, his pen-jacket to a shawl, and you have a keen-faced old granny. Put on appropriate whiskeen, double chim, buts or caps, and jackets, and you can even change his nationality.

You may also want to try an entirely different figure from a pottern you've found yourself. Simply get front and ude views of whatever you want to make, transfer them to an appropriately shaped block by the method of comparative squares shown in Fig. 1A, and whittle away. And remember that you don't have to make the skipper the size indicated.

Use 1/4 in aquares and halve all try dimensions, and he'll be only 24/4 in tail—that is, the actual size of Figs. 1A and 1C Lsa 3/4 in aquares and double all my dimensions, and he'll turn out to be 11 in, tall

So there you are, a sculptor in wood—and l'il bet you thought it would be hard, didn't ou



Steeve creases and details of Jacket

SMALL TOOLS KEPT ON CORRUGATED BOARD

One model maker, who uses many small tools, keeps them on a square of corrugated board so that they cannot red off and fall to the floor. The board is single faced, and a to fit square of it is glued to a square of plywood, then puinted black so that tools and small parts placed on it can be easily distinguished and picked up.—W. K.

AMMONIA CLEANS RULING PEN

RULENT pens used with Judia ink can easily be cleaned of incrussed ank by applying a strong ammonia solution with a soft cloth. Afterwards rinse with clear water and dry.

SHALL I ADD OIL OR CHANGE IT

Which is right? Conflicting recommendations by car manufacturers, infrefiners, service stations, and other motorists have caused millions of car owners to wonder. Some say: "Just keep on adding oil." Others advise "Drain and refill twice a year" or Change oil every so many milet. "But in the meantime, the automobile repair bill of the nation continues to increase.

There are very sensible reasons why oil should be completely changed as regular intervals. Oil at work in your motor is contaminated with many things durt and dust, fuel residues, moisture, and minute metal particles.

It is true that oil filters help to prolong the useful life of your oil. But even if you renew it regularly, the filter cannot remove all of the foreign substances that collect in your crankcose.

le is also true that Quaker State has been able to climinate the "light-end" material found in ordinary oil—thus ancreasing materially the efficiency of the oil. But even this advance is oil tehning doesn't temove the necessity for regular crankerse draining.

How often you should add oil or change it depends upon the conditions under which you drive your car and the brand of oil you use. Some oils go to pieces under the terrific heat of your motor long before the accumulation of dirt, etc., would normally cause you to change.

There is only one sale and truly economical rule: use the best oil you can buy — use Quaker State — and dram and refull your crankers at sale and regular intervals. Quaker State Oil Refining Company, Oil City, Pa.

"First choice of Experience"

QUAKER STATE MOTOR OILS

SHOOTING HOLIDAYS

SHOOTING

New platures—135 searching photos pau indiffration; threating established to right name of the photosing and shad their hand from platet marks.

Red from platet marks

**Red from

MODEL 49
New 22 cal. W ashester
Reposter but us so,
las magazine, 6 shelp.

MODEL 62
A)0 bery depending Shedger sheets
the unantished
3 seek shell Light.
Carib handing, For
therity of all 1906.

APPY DAYS
Healthy days
Days of fast nating informs in again sed am
you are sport. Get out your
kon and have some bun.
It get yourself a new
We nebester—a amart, new,
1913, amaring y liveproced Mosto of Repeater,
for chample Greaten gun
you a fur the money
Winchester has ever of
letted. An incorporative,
half title, accord of all

tound to repeacing rifle for area wither, according to the for area wither, and its Or get vouche to ray sight Winchester blouge 42. Repraining Shortgun. The alignst that has put about 14 his about an about a spot agent to the epotaghs. With does not make in Skeet highs report Lattie point. Powders hand trap that programs the alignst The Fability shortgus for shooting holidays.

Top These Popular Wiceharters
TODAY Look then over a so the other famous
We introduce forms from them by the class of your or
or a For subsequent sphere, and fullers, and respect to the

WINCHESTER REFEATING ARMS CO. Big 34-C NEW HAVEN, CONN., U. S. A.

Sure thing) Mall me FREE year 1916 "Shooting Holidays" and faiders on Models Af and C.

NAME

HE WAY

Crystal Radio 25c

the tip get receptions

stilled you may be too

as he up to fine
to talk for every fabrice
curs them. It is to

and the part fabrice
curs them. It is to

and the part shorter
and you are all

tel 1 to tell
pletaly meaningles

are 1 to be the

protection for one is

protected for one is

and no hat advise many are all the hat advise many are all the same and the same all the same and the same are as a same are as a same and the same are as a same are as a same and the same are as a same are as a same and the same are as a same

WOOLD NOVELTY CO., DEPT. 197, BACHE, WILL

Make Money in Spare Time

Its a representative of Popular Science Monthly Taking attached plant of the new less private stage And you can have good money at it. Write for particulars in Popular Science Manchly, Disculation Manager, 363 Franch Avenue, New York.



FINISHING OUR NEW RACING RUNABOUT

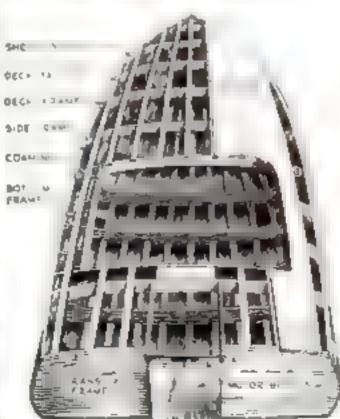
Continued from page 67

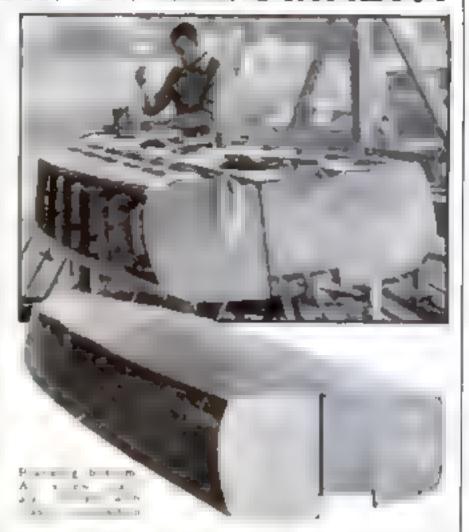
from the keel) between stations 2 and 3 and use one plank in their place from that point forward Butt blocks of the same thickness as batters should be used at these joints

Start by laying the first two planks on either side of the keel. Just before acrewing down the planking, cost with marine glue the buttens. transom, stem, keel, chines, and all joints that need to be waterproof then lay a strip of cotton flannoiet over the glued surface. Cost the cloth with glue. When the planking is screwed down, the glue will be squeezed over the entire joint making it completely waterproof, Also, the cloth will hold the glue in place indefinitely. Smallbattens that cover the bottom Iransom seam should be made waterproof in this manner No. clath or marine give will be needed, of course, in

when a plank is being fastened, it should first be clamped in place; then holes are drilled in it for the screws. These screws should be counterwink enough to allow for covering later with putty or seam composition. Screw the side and bottom planking with flathead brais or galvanued screws as follows: (1) A double row into transom and transom frame, 1 in. No. 6, spaced about 1 in. apart, (2) into stem, 1-in. No. 6, spaced not over 1 in. apart, (3) into keel, thines, inner chines, and frames, 1-in. No. 6, spaced about 1½ in. apart, (4) into buttens, 34-in. No. 6, spaced about 1½ in. apart.

Some planks will have to be steamed, especially the ends of planks near the stem and hottom side planks near the transom. To steam a plank, wrap with raps the part that is to be bent and then soult the raps with boiling water. Once the raps are taken off, the planks must be quickly clamped and screwed into position before they have time to dry





Before the top side plank is put on, the boat can be removed from the supporting framework and set, right side up, on borses. Fit the breasthook against the stem between the two top trattens before the last two side planks are put on Screw through the battens with 1 4 in No. 7 screws.

After the side planking is completed, true up the deck beams, bevel the battens and planking along the sheer line, and bevel the top of the transom and transom frame, so that the decking will fit properly Be careful to get a true curve of the deck fore and aft, especially at the sheer line and center line. The anall deck frames Nos. 7 and 8 and abothe committee can be put in at this time.

The deck frame to which the lack rest is to be fastened can be set up at any desired angle it should be fastened at each side to small cleats attached to the two top battens; and at the center it should be connected with a block to deck frame No. 9, as shown in the drawings, with 1½-in. No. 7 screws, Screw

the coaming to this seat-back frame and to deck frame No. 6 with 1½-in. No. 7 screws, but 34 in. No. 6 screws will be large enough for the rest of the con-

struction just described.

Next, the two knees that brace the transom to deck frame No. 9 should be fitted. Fasten them with small angle troos and bolt with 11/2-is. No. 10 machine screws. Notches can now be cut for the deck batteza. They should be spaced about 51/2 in apart, approximately as shown in the drawings, and fastrued to the sheer batten and to the frames with 11/2 in. No. 7 screws, The center batten will be notched part way into the breasthook. Screw the deck to the batters, deck frames, breasthook transom, transom frame, and sheer but ten with 34-in. No. 6 screws spaced about 2 in. apart. No marine glue or cotton flannelet is necessary, but the entire inside of the boat should be given a cost of paint at some time before the decking is laid, and all the decking should be painted underneath beforehand.

It will be best to put in, before all the decking in on, proper bracing for the type of steering (Continued on page 93).

FINISHING OUR NEW RACING RUNABOUT

(Continued from page 92,



Storn view of the portially completed beat after being turned right side up Lebtover process of planking are used for the flooring

wheel to be used. The flooring can be made from extra boards left over from the planking. The seat back is plywood.

The entre hall should be well sanded before the priming cost is put on. All screws should be covered with putty, sense composition, or a plantic wood composition. The entire hall should have at least two costs of marine chainel or spar variable.

To obtain a pateral mahogany finish, first color the bull with either mahogany filler or mahogany stais. Apply either of these with a bright and then wipe off with old rags. Cover screw bends with mahogany colored seam composition. For an extra good racing bottom, use at least three costs of special hard, racing bottom finish; get instructions for applying from the point manufacturer

To mark the water line, first set the boat up evenly on a level floor, then mark all the way around the hull a in, up from the floor. The sheer molding and fender molding can be either half-round hardwood or \$4.10, half-oval brast, screwed to the battern with oval-



A bow view, The deck beams should be trued up to give a smooth, fair curve fore and aft

head bruse acrews. A strip of \$4- or \$4-in half-oval bruse should also be used to protect the atem. A how plate or some fitting to which a tow rope can be attached is required by the racing tules.

The best and simplest way to book up the steering outfit is to use four pulleys, and to run the tiller line or cable to the steering har through boles bared buth in the transom.

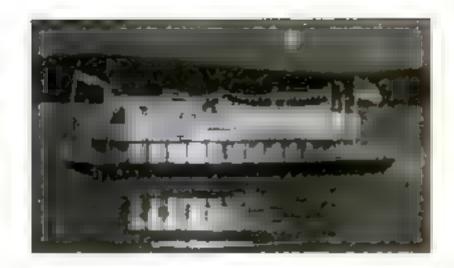
In order to get great speed, have the transom as high as the motor being used will allow. Experiment also with motor angles.

BOAT CHANNEL OPENED BY DRAGGING CHAINS

SHALLOW channels that become filled with sediment from the action of the tide can often be kept open by the use of chains. One strumer resident of Maine, who had a channel blasted so he could bring his boat into an inject, always fastens several chains about 30 ft long to his boat when going in and out. The chains stir up the sediment, and the tide then clears the channel.—O. R. McD.

MAKE A COMPLETE MODEL

of the



MAXXXILL HOUSE MAXXXILL HOUSE

It Lights at Night

Now you can build a beautiful, illuminated, true to-scale model of Captain Henry's famous Show Boat from this simplified kit containing step-by-step instructions, blueprint, and every piece of material needed in making the model

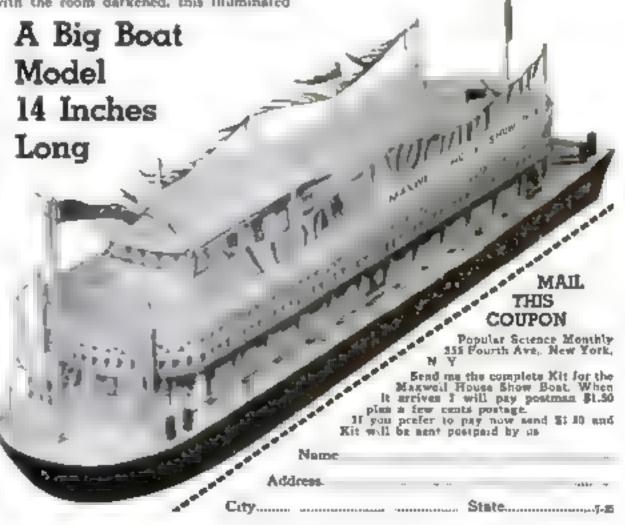
All the necessary wood, paint, printed deck houses, the cut radings, glue, minis ture electric bulb, battery, and flag. Nothing class to buy

This is each model represents a typical Mississippi River traveling theatre of the 1470's and 1580's. The kit includes a variety of paints so you can decorate your model as colorfully as you like. A sharp knife is practically the only tool you will need from the time you open the attractive package containing all supplies till you have a gaily decorated model of the boat now famous from coast to coast—Captain Henry's Maxwell House Show Boat

Captain Henry's Maxwell House Show Bost Sitting on your mantel or radio at night, with the room darkened, this illuminated Show Boat will make a thrilling sightone that cannot be duplicated by any other model, one that you will value high by, and one that will be admired by your

The instructions are written so clearly and illustrated so well that anyone can camby make this valuable model. All the supplies have been proposed from high grade material by experts especially for readers of Popular Science Monthly. To get this lot right away fill in your name and address on the coupon below. Clip and mail it today. Send no money now unless you prefer to. We send it C. O. D.

DEALERS! Write for terms on this new kit





Always mention POPULAR SCIENCE MONTHLY when answering advertisements in this magazine.

MARVELS OF THE EARTHWORM SHOWN BY YOUR MICROSCOPE

(Continued from page 41,

pairs, four pairs to each segment. There are two rows along the lower surface of the body, and two along the sides. The setae are chitmous, and if the muscular tissue in which they are embedded is torw apart with dissecting needles, they can be removed. You will find that each little foot or claw is shaped like a letter 5 that has been pulled out almost straight

Perhaps the most beautiful part of the enrithworms whole anatomy is the cutofe—the transparent wrapping that covers its body. This cutofe can be stripped off as a very than, delicate film, particularly after the specimen has soaked for a day or so in the for maldehyde solution. With tweezers, transfer a piece of this membrane to a drop of water on a slide, and lay over it a cover glass. Because of its thinness, you penhably will have to adjust the substage diaphragm to a small opening. If your microscope has no chaphragm, put a piece of cardboard or metal



Portion of a neght diam, as excretory organ. There are two of these to nearly every segment

having a small hole in it between the mirror

Staining with methylene violet or other standard microscope stain will make the membrane easier to examine. You will find that it looks like a piece of fine silk with polka dots. The dots—frequently they look like black dots—are tiny pores through which secretions pass.

But the most striking feature of the cuticle in its iridescence. When you hold the slide up to a light and turn it, the bit of membrane will be seen to resemble mother of-pearl or the pearly luster of certain fish scales. It frequently appears highly colored

If your microscope is equipped for dark field illumination, you have a treat waiting you can transform the bit of cuticle into an indescent fabric that glows with a blush linter. You can preserve the specimen of membrane indefinitely by substituting glycerin for water as a mounting medium

The earthworm has two layers of muscle that form the seemented outer wall of its body. Outside, just beneath the epiderans, is a tayer made up of fibers which run around the body in innumerable rings. Beneath this is a layer of muscle with fibers running at right angles, that is, lengthwise of the body. With these fibers and muscles the worm can make itself long or short, fat or slender, as may be necessary to its active life.

To see the individual muscle fiber with case, you must tear a bit of muscular tineae to shreds. You can do this with some decree of success by brute force; but it is more scientific to isolate the fibers chemically. The dissolution, of which there are several kinds, softens or dissolves the material that holds the cells together, yet preserves the cells in their true form. A nitro-and solution, made by mixing one part of acid with four parts of water, is commonly used for muscle. Let the specimen remain in this solution at room

temperature for about three days. Then wash it in water to remove the and, and separate the fibers with teasing needles. Further desociation can be accomplished by pressing or tapping on the cover glass after the specimen has been mounted in water. Tissue generally is preserved in a two-percent formaldehyde solution (one part forty-percent formaldehyde to athereen parts of water) after being removed from the dissociator.

You will find that the earthworm's nervous system lies for the most part along the floor of its body, beneath the injection. It appears as a white cord having a slight bulge and three pairs of branches at each segment below the fourth. You can remove this cord easily and place it on a slide for observation.

THE curthworm's brain is found in the third segment, counting from the head and omitting the fittle buttonlike nose or proston um. The brain looks he was small, whitish bush, or lobes, lying above the pharyon. From it, two bundles of nerve inside extend around the pharyon and unite at the bottom, from this knot? the nervous system continues as the ventral nerve cord.

To dissociate nerve timue, a formaldehyde solution is used. Add one part of forty-percent formalin to 500 parts of normal salt solution. Let the timue remain in this liquid for an hour or so. To make a normal salt solution, add one part of common table salt to a mutable parts of water. After the nerve tissue a dissociated, it this be stained with costn or any other suitable stain.

Every somite or segment of the worm except the first three and the last carries a pair of excretory organs or nephridis, to carry waste matter out of the body. These are coiled tubes leading to the outside through a tiny opening in the body wall. You can see these tubes with the unaded eye, in a large worm. They lie close against the inner surface of the body wall, about halfway upeach side, their openings are near the bottom rows of setae. To lift a coiled nephridium out with tweezers and transfer it to a abde for observation is a simple operation

Permanent slides of bits of times may be made with glycerin as a medium. The glycerin between the specimen moist, and in a natural condition. It is not good practice to immerse the object suddenly in strong glycerin however, Instead, transfer it to a fifty-fifty maxture of glycerin and water, then, after a half hour or so, to a drop of pure glycerin placed to the center of the slide. If the object is thack, use a cell of shellar or a ring of plane or cell alord remented to the slide with balsary or shellar

WHEN the object is centered properly, breathe on the cover glass to make it most and immediately lower it onto the little pool of glyceria, do not include air bubbles. Wipe away, with a damp cloth, any glycerin that coses out at the edges of the cover glass. Then tack the cover class in place by applying shelling at the edges. Finally, seal the glass all ground with shellar, sold size, or asphalt various

A glycerin mount is not so ranged as one of balsam or some of the other mounting materials, but with reasonable care will last for a long time. To senew the gold size or other sealing material from time to time may be necessary if the side is handled roughly. It is best to store such sides so that they lie flat rather than stand on edge.

The earthworm can readily be slitted into thin sections on a microtome. It is, of course, necessary to prepare the worm so that it can be sectioned without (Contrased on page 95)

MARVELS OF THE EARTHWORM SHOWN BY YOUR MICROSCOPE

Continued from page 931

being crushed. The usual method is by embedthing in paraffin, a process that requires considerable time and skill. Converting two or three aggreeats of an earthworm into slaces a few thousandths of a mili-meter thick would involve processes something like the following fixing for an hour or so in a tenpercent formalia solution, followed by washing for thirty minutes in running water, and hardening for at least a day in seventy-percent to eighty-five percent alcohol, dehydrating by leaving for several hours in minetyfive-percent alcohol, and then overnight in absolute alcohol, clearing by immersion in cedar oil or aylol until the specimen becomes more translucent and sinks to the bottom, immersion in melted parafilm for a few hours, until the paraftin has penetrated the tissues completely; Snal embedding by dropping the specimen into a paper-box mould containing melted paraffin that has started to barden at the sides and bottom, and then quick immersion in cold water

THE specimen, surrounded by the paraffin which prevents the delicate tissues from being crushed or displaced, is sheed into thin sections on a hand or mechanical microtome. It would be extremely difficult to do the slicing by hand. A nucrotome (P. S. M., June '33, p. 32) is almost a necessity, for making this sections

Each thin slice of paraffin containing the tissue to be mounted is cemented with egg albumen to a clean slide, the paraffin dissolved away with xylene, the tissue stained with harmatovylin, coun, or other stain, and finally a drop of balsam and a cover gians are added to protect it

This is, briefly, the widely-used paratinembedding method of making sections. Of course, there are variations, according to the specimen, and the worker's pet ideas. It is time-consuming but gives excellent results. There is, however a second quocker method which you may find workable. For the piece of earthworm in ten percent formalin, harden it in alcohol as described and then transfer it directly to a motten mixture of one part of vaseine and three parts of paraffin. When this has hardened, since the block into than sections, cement if to a saide, and dissolve away the paraffin-vaseline mixture with tylene. The final step is to stain it and mount it.

The most interesting sections of the earthwrotm include cross sections through the body longitudinal sections through the first dozen or to segments.

Do you remember the sand you found in the worm's intestine? This will damage the edge of the razor or microtome, if left inside the specimen. Therefore, before attempting to sace up the earthworm, put it for two or three days on a deet of wet paper nothing more. That is, put the worm into a box containing torn and well wetted newspaper, and left it eat the paper. Eventually the sand and grit of its normal earthy diet will be replaced by the easily-cut paper fibers.

THE earthworm is valuable to you and to everyone che for remons other than its excellence as a soological specimen. It is one of the most efficient soil-fertilizing agents known, it continually bores through the earth, and swallows soil which later is cast out enriched by nitrogenous waste material, while its burrows allow water and oxygen to enter and sod further the soil-building processes. Over a period of years, the thousands of earthworms to each arre of land will deposit on the surface several inches of enriched soil, covering rocks and other unproductive material. We ail owe a lot to the earthworm

POLO PLAYED ON MOTOR CYCLES

(Continued from page 43)

to the temporary removal of a player from the game, without another being permitted to replace him, or to permanent removal with the substitution of another player

A goal made in the course of play counts two points. A successful peopley lock scores one point.

The typical motor-cycle club, composed of siders who find as much fun in various motor-cycle activities as the rifleman does in shooting at game or largets, or the stamp collector in studying the peculiar dots on a new alread stamp, finds in puls a way of adding spice to week-end programs.

The person who considers a motor cycle only as something for a traffic officer to ride, has little or no conception of the peculiar appeal of this two-wheeled "hobby-horse." Motor cycling is definitely a hobby to thousands of enthusiasts all over the world

BESIDES polo, the motor cyclist has hill climbs, dire-track races, short-track races, mad races, side-car races, night speedway racing, endurance runs, reliability trials, economy contests, non-stop contests, field meets involving gymnastic riding and various other stunts, grass track racing, "T, T" (Tourist Trophy) tacing, and a host of other ways of making life interesting. It sometimes is difficult to say which of these sports provides the most thrills, or involves the most interest. Motor cyclists will cross states and continents to engage in hill-climbing contests or races, and sometimes only to watch them!

"IT I raining which duplicates in taining ture the famous Tourist Trophy races held each year on the lise of Man, is proving propular with motor cyclists. Short but difficult courses are field out in such a way that they usvolve right and left turns, hills, and similar means of testing the skill of riders. A race usually includes several laps, the winner being the one who makes the trip in the shortest time. It is a hodgepodge of had climbing dirt-track racing and several other varieties of motor cycle sport. Spills generally are frequent, hence the regulation requiring contestants to wear leather crash believes.

PREOUTNILY a pole game comes as the climax of a Sunday of activity. It may be preceded by a road tour, a "T T" race, hill-timbing practice, or other events. And then some of the players wonder why they feel a lat stiff the next day!

Wives and sweethearts frequently are on hand traveling as back-seat riders. There are surprisingly many women who participate on their own machines, authough they usually leave to the men the climbing of perpendicular hills and the jugging of pole motor cycles.

Unlike the polo pony, the motor cycle is a relatively inexpensive mount; playing of the game does not involve costs that would make it prohibitive to all but the wealthy. For that reason, you probably will hear much more about motorized polo in the future than you have in the past







"Look in the Hood and Sec." Amateurs and professionals rely on Graffeit Cameras for their "more moreerting pictures." One Geafler Focusing Hond in it you see the picture as you get at GRAFLEX arteo GRAPHIC FOLMER SHAFLEK CORP. ROCHESTER, NEW YORK Dept F S 7 Kindly send me without oblifation your flustrated Carely and name of nemby GRAFALX FREE! 32 profusely illustrated pages of absorbing Griden fen-

State

puces. Of interest

LO EVERY DEO-

togespher and

popplat.

Eitz

Secrets of Success STORIES THAT WILL HELP YOU GET AHE ID





ноі

PAY AS YOU LEARN FROM SPARE TIME EARNINGS

Void rout got drift War. Controlled to the Mark Coupon Now the State of the State o

MOTOR INSTITUTE OF AMERICA

22 60 Lawrence Avenue, Oldongo, III., Oupt. 9-12 Without such or solding but to the first open And a South with the first of July Way. Home Tradular and Homes Such Accommend Name

RADIO EXPERT Learn at Home-Make Good Money

Mat' he sushed. More theft I thained at home in spate one make 4 n thin 5 ha needs 3 saty home 55 \$10 f. a needs in space one notice tearning. Get for aless: Mailte a opporting real still not and highly place of in the first hand and proper expect ments, spate in the section and the property of the section of the first part of the first part of the section of the

E BMITH President, Bent, Matterni Radio (getfryte, Water	36,63
Marthungs Rudin ingelogin. Widdit	Injine, D. C.
Helet the time free help Riv	h Mewards in Radio
The date that will gate her a se-	care prists plant r
Valor	4 1/9"
teldress	
Cita	Market

MAKE MONEY CAMERA

Identify A on the couples of the set in Thinks of the African have to make the hand of planes usuated for the couple of the set in t

DON'T BE A PIECE OF HUMAN DRIFTWOOD

TO SHIP shoves off without destination, yet how many men put out aunlessly on the sea of life with little or no idea where they're going or how they're going to get there! It asn't long before such frail vessels become driftwood—tossed here, swirled there -until the sea casts them upon the sands of time to complete their disintegration.

A few days ago we had a letter from a man in Mexico-a letter of regret. It is not a success story; quite the opposite But we publish it here because we believe that any man who wants to get ahead will had in our correspondent's drifting the insparation NOT to do as this man has done

"Having always been afraid of facture", he writes, "I invariably fail as I dure not try. And if nothing succeeds like success, conversely, nothing fails like failure

"But if my simple story will help even one poor devil to avoid the mustakes which have left me (at an age I hate to remember) sans achievement, sans money, sans anything, why then I won't feel such a failure after all

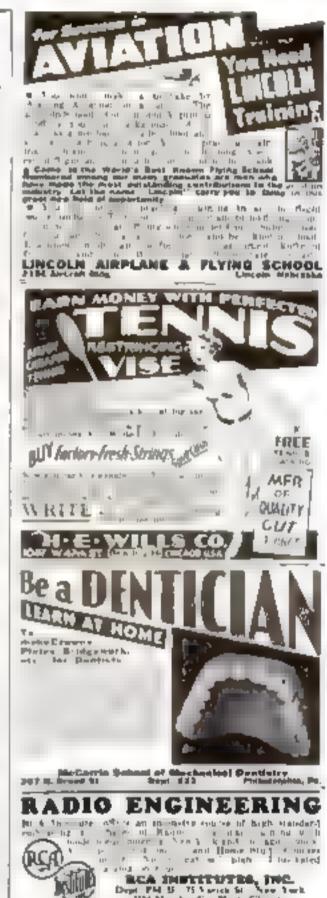
In the first place, drifting is not only my middle name, but my first and last ones as well. Even yet I haven't decided exactly what I want to do, or to be. I have several preferences and some times dedicate myself to the study of one or the other. But in a few days, before I know it, I've dropped that and find myserf taking up something else-

Stronge to say, the vocation that I have never preferred (in fact, the last one I would have chosen) is muse. Somehow in the most casual manner, I found myself pounding languages into wooden heads for a living. And if I had my choice, it wouldn't be teaching languages or any thing else.

"The only complement that I can give myself is one that I have often received from other people—that I am an excellent teacher. On the strength of that proise I stack to my deak and the wooden heads fearing that I might not be excellent, or even passable at anything else

"Hating change of any form, I am an adherent of the cult of letting well enough alone, even if it isn't so well. Besides I never do what I intend to, and always do what I have decided not to do And although I have ambitions a-plenty some how that is as far as I ever get No 1 am not lazy; so I cannot blame myself altogether for not doing something or being somebody. Somehow I've never seemed to have bad a chance. But I do blame myself for not making chances although this is very hard for one who is not by nature a do-thinger and a gogetter. I just wait for something to turn up, and—nothing ever does.

"Due to my lack of instative, none of my plans for myself have ever material-

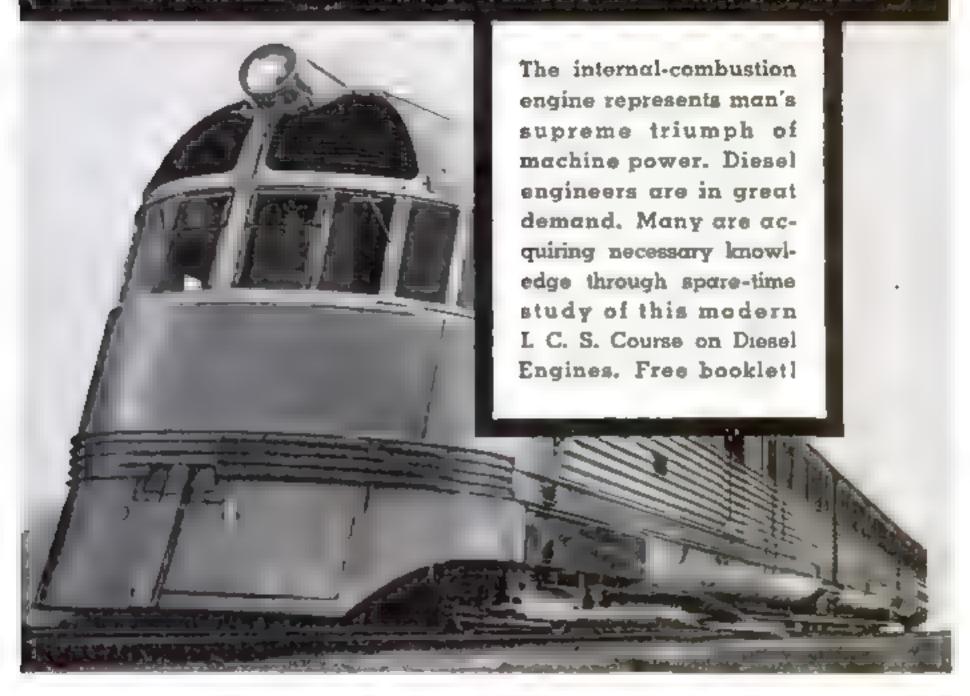


Dept. PM 35 75 Variet 54 New Y 194 Marchaelie Mart. Chicago Bongstund Standard in Bodyn Instruction Steam 1999



DIESELPOMER

Coming American Industry



ITN'TERN'ATRONALISO RRESPONDENCESSON NO LSA

"The	Despersal	Umorraly*	В
------	-----------	-----------	---

OX 7648-H, SCRANTON, PENNA.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why." and full particulars about the subject before which I have marked X:

TECHNICAL AND INDUSTRIAL COURSES Brider I nameet Brider and Building Forestate Highway Englacer Civil Englocer Surveying and Mapping R. R. Larottothets R. R. Section Forestat

- Architect Cehites ural Brattsman Building Farmaning Contrac or and Builder
- S ucid a homogen Flectairu Formeer
- Free ric Lighton, [Wiring Telegraph Engineer Telephone Work [Radio Referention
- □ Business Management □ Office Management Lodustria, Management
- Personnel Management. Traffic Management 4 Account Miles y
- Welfing Freeze and Gas Read of Shop It seemeds Fa ternessher Boulernaker
 best Vetar Wocker
 Pumbrug (18 cm.)
- [) & ruch Fitting [] \ em avera [] Trasmith Pipeliter La Conditioning Automobile Mechanic
- BUSINESS TRAINING COURSES Cost Accountant
 C P Are untant
 Reachkeeping
 Secretarial Work
 Samuel Secretarial
 Samuel Secretarial
 Samuel Secretarian

Vavigation

Complete Commercial

Russiana Compendence

Receive Show Cord. SuperStep Couply and Tricine

Coll Service. Mail Carrier L. Rustway Mail Clerk

C R. Signalorea

Are Brakes Train Operation

Ges Engines Direct Engines

Availant Engines

- Mechanical Engineer Mechanicas Pracionad Steam I og serr Steam Electric Engineer Marine Engineer Chemistry | Planmacy Cotton Manufacturing Woolen Manufacturing
- Woules Manufact
 Agricus are
 Fruit Growing
 Poultry Farming
- Grade School Subjects
 High School Subjects
 College Perparatory Elfostration
- Lumber Dealer

Newton white a marriage was accounted

Com. Mining

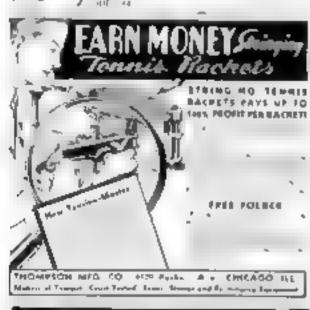
Citymon a wine we

Present Position ...

If you reads a Canada, send this empow in the Interactional Correspondence Schools Consider. Lauried, Mantreal, Courte







Secrets of Success

ized. As one instance of how all of my hopes have been frustrated. I, early in life, decided that I would live some day in one of our northwestern towns whose name spelt enchantment to me. I always loved things northern—pine-covered mountams, snow-covered peaks, gray skies and Stormy waters.

"Do I live in that mystic northern land? You would laugh if you knew where I have spent most of my life! Of all the God-forsaken, sandy, cactusy desert regrous, my habitat takes the cake. Here the sky is forever blue, and the sun shmes 366 days in every leap year

"If it were possible to change a vacillating nature like mone, I would turn over a new leaf; only, the leaf would not stay turned very long."

Brainy enough to teach languages and to be highly regarded in that profession this man still thinks himself as a failure All through life he has drifted-without planning, without objective, without ever making an important decision. Had he started earlier he might have trained his must into orderly thinking but he believes it's too late now. And more's the pity because apparently his is a good mind.

Thousands of successful men today once were in the same spot in which you may and yourself-or in that of our correspondent years ago. They have acrived because they knew where they wanted to go and prepared for the journey. Few of them have had any more time to train their minds and hands than you have. But every space moment was an opportunity and they sessed it

If you are fust starting out in life decide now what you want to do. Then set your course and hold to it

CHIEF ELECTRICIAN IN LESS THAN A YEAR

WEN in these times the road to suc-, cess is not always rough. For some it is a broad, smooth highway with out hump or detour, traveled at an almost breathless pace, Take Charlie Peters, for example. When hardly out of high school Charlie breezed into one of the finest jobs any young man could seek, simply because he made up his mind where he wanted to go and planned accordingly.

Charles was interested in electricity but -in his own words-he "didn't know a volt from an ampere." Yet less than one year later, at the age of 21, he was making good as chief electrician for a large electric refrigeration factory in Machigan. and supervising men twice his age

When Charlie left high school and started looking around for a job, he very soon discovered that the average prospective employer is not particularly interested in high school diplomas. The first question asked was: "What can you do?" It started Charlie thinking, and it didn't take bun long to reach the conclusion that specialused training was the key to his problem.

Not long after that Charlie, in reading a magazine, discovered the advertisement of an electrical school in Chicago, which offered a practical course of training in



GFT READY FOR PROSPERITY Be ready for BIG PAY I we train you at your home by mail on Practical Practiced until IN POSITION of prepare you for BETTER PAY on the Joh you have. All tools and drawing table sent at once if you enroll now.

R. H. T. Frik FFFF BOOK on Drawmanship.

ENGINEER DOGE, Div. 5-110, Libertyville, III.

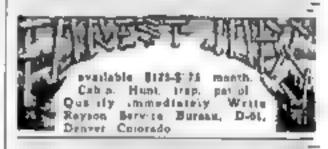
endowed by in-factor 43rd and Catalog.

BLISS ELECTRICAL SONDOL

para lime. Also dark whi a year there. No experience decimary. How easy method. Buthing a so the It. and at some for free book. Opportunition in Modern

MAN IN EACH TOWN-

To Plate Auto Parts, Reflectors. Bathroom 7 states Reliand Beds Vertica, Changehere by new method on capital ar expefurnir required Sympto lan of manufacsating at home sia - you for big money mak a business Onthi lurnished. Free particulars and proofs, GUNMETAL CO. Ave. F. Decatur, IR.



CIVIL SERVICE

er them. Clerks Cappilers Bard, Casteley Balteria on resides instanced to them, but to be Wish Tiles the de-d short of their Supercount against the selection of the highest a to be place. Where the new color plants or configuration of the new of the Section Fact of the September 1 making er in tertifica Calculate Correspondação Cribiga



Follow This Man

florest for priors (specular pla in in an interprior for the last in a part of the prior of the

HAVE YOU SOME SPARE ROOM

an S many products where we can be called work. We and S many products proper works that A faired a most be because to Tay has continue and the A faired at Tay has continue and the faired for the faired at the faired for the faired for the faired at the faired for the fair the faired for the faired for the faired for the faired for th a bei spaced or garage above, ou can do sald work. We

METAL CAST PRODUCTS CO., DEPT E



MAYE SERVE COMMON, Supt. S.X. San Z.L.M., Chapterd, Chie



Appropriy goods at the continued the continued to the continued and the continued at the continued and continued at the conti

GET A GOOD JOB IN AVIATION

PREPARE QUICKLY AT HOME IN SPARE TIME

Abuntint is proving that. Abditions much and detired food jude with cost futures. Provinced up to-date being tracking present of the provinced up to-date being tracking present of the provinced up to date being the date of the present of the pres







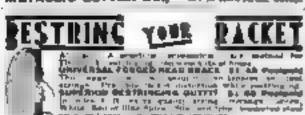


Always mention POPULAR SCIENCE MONTHLY when answering advertisements in this magazine.

AGENTS 500% PROFIT GENUINE GOLD LEAF

Goaranteed to never turnish. Anyone cast put them on stores and three a notwer betogen them on stores and three a notwer betogenhouse the sample and liberal offer to general agents.

METALLIC LETTER CO., 47 K Det Stat Giore



reference of the next letter benefits to be a second to be a secon The Tennis Equipment Co., Trantac, II. J.

electricity and refrigeration. Here was exactly what he wanted, and he went after it. Upon graduating, he returned to his home town to land a job with a leading equipment manufacturer. Success was his from the start and after several increases which came with surprising rapidity bewas finally promoted to the position of thief electrician

Starting from scratch, without advanced education or previous experience, Charlie Peters carned promotion to importance i and responsibility within six months after i he acquired the necessary specialized training, actually out-stripping "old-timers" many years his senior

Granted that Peters' achievement is unusual, there's no denying the reward which awaits those who will develop their native ability Employers respect intelligence, couple it with training, and respect will take concrete form-in the pay check.

FOR FIVE YEARS FATE PUSHED HIM AROUND

OME might say that Winchester Marquart picked a poor time to be born. But having come into the world just in time to run up against the depression upon graduation from high school, this Jersey City, N. J., boy refused to let it stop him. Today-at 25-he occupies a possuon many an older man might envy

Marquart didn't get there by any bocuspocus or because he knew somebody with influence. His sole equipment was good average intelligence, good health and courage. And don't think he didn't get knocked around the first couple of years out of school. He had only begun an industrial chemistry course in New York when the punch came at home and he had to look for a job

His first two positions went the way of so many during the economic decline and within a year and a half he was hunting his third. This lasted a year-seven months of it on the night shift-and then it, too,

By now Marquari was pretty well fed up with insecurity, night work and employment conditions over which he had no control. One thing he had observed, however, gave him hope. Trained men in the various places he had worked were kept on, the untrained, let out. He determined to become one of those trained menby studying at home

Just a little more than a year ago, the United States Government held examinations for storekeeper and gauger of liquots Marquart was one of the many who took them, and came through with a rating of 86.25% which put him near the top of the climbility list. Shortly afterward, he was notified of his appointment with a starting salary of \$2,000.00 a year and real respon-

Now for the first time in five years he us empoying the security of a good job. backed up by confidence in his ability to hold it. True, Marquart's is a career just begun. But by intelligent preparation he's laid the groundwork for bigger and better things later, and when the next opportunity comes along he'll be ready to grasp it.



Become an Expert Accountant

The profession that pays

The demand for skilled accountants—men who really know their business-is increasing rapidly. New state and federal legislation requires much score, and more efficient accounting from bustnew -big and small. Corporations are in constant need of export counselin matters relating to Auditing. Cost Accounting Business Law, Organization, Management, France. Men who prove their qualifications in this important branch of business are rapidly promoted to responsible executive positions... given an apportunity to earn real salaries. The range is from in and to \$15,000 a year-even to higher income-

Send for Free Book-

"Accountancy, the Projession That Pays"

Why let the other fellow walk away with the better job, when right in your own home you can equip yourself for a splendid future in this profitable growing profession?

Inder the LaSade Problem Method you can ecquire a thore understanding of Higher Accounting master its fundamental principles, become expect in the practical application of those principles this without losing an hour from work or a do. ar of pay.

Your training will be under the direct supervision of a staff of legal, organ sation and management specia ista, bus ness afficiency engineers and Certified Public Accountants.

Prekininary knowledge of bookkeeping is unnecessary. Our free book on accountancy faily explains how we train you from the ground up, or from where you now are, according to your individual meeds. Low cost; easy terms.

If you are dismissful with your present equipnent, the enopour, not below this sent will bring you the true facts about present day apportunities in Acrousting, all without obligation.

The man in surrest to get about will find this Ottpon his most profusble aid to progress,

				_
ı	LASALLE EXT	ENSION 1	INIVERSE	TY
	The School That Ha	Tretand One	# 1,300 C. P	AT
	Popt, 783-HR	Charan		

I would wylcome details of your therein building plan in accounting ingestion with empty of Account ancy the Profession that Pays," without

Higher Accountancy Training for published Audit of Comp-trailer Cartiful Pathie America and

Other LaSalle Opportunities: LaSalle opens the way to success in every impossion! field of less need -11

in terested in owe of the Solds below, check and mall, **Peninses Management** Law Degree of LL. S. Medeva Satesmanship Modern Business Cor-Tentile Hamager proposition, a Expert Bookkeeplag Ballway Accounting F A Courbing Commercias Law Industrial Manager Budgem Fud al. Medern Personality Effective Spenhing Stonetypir Personnel Management Practical Associating and Office Managem

Hame		
,1 L.	118	
Present Position	103114 0444	
Address		





325 Woot Huron St.,







AMAZING FEATS OF BLOODHOUNDS

(Continued from page 25)

the bloodbound. And, curiously enough, the bloodhounds in Harriet Beecher Stowe's story weren't real bloodhounds at all. To understand this, we will have to run back for a moment over the history of the animals.

In tapestnes 400 years old, you can see the forms of does that have a ciose resemhance to the modern broadhound. The Romare are said to have used such does for hapting the wild boar. Introduced into England, the dogs were found to be too slow for stag hunting. So, according to one legend, breeders crossed them with fox terriers and produced for hounds.

T IS doubtful that any real bloodbounds were brought to America until after the Civil War. The dogs used to trail and in-"Cuban bloodhounds." These feromous beasts, part mastiff or great Dane, and sometimes part buildeg, had only a little bloodhound in their make-up. They hunted a man down just as they would an animal and attacked and tore him when they overtook him. Such were the "bloodhounds" of the early South and "Uncle Tom's Cabin." Pure-bred bloodhounds of today will leap up at a treed man, but they are merely trying to sniff him to be sure they have the right person.

After the Civil War, pure-bred bloodhounds were imported to America. Since 1900, it is estimated, \$75,000 worth of bloodhounds have come to the United States. Only a few lived, for the animals are relatively

delicate and die eauly.

Several years ago, I began an experiment in developing bloodhounds with increased vitality. Whale traveling about the country in connection with the work of the American Eugenics Society, I kept my eyes open for female bloodhounds, seven years old or older By the laws of heredity, they should produce long-lived puppier. All over the country, I bought up the old dom and shipped them to my kennels in New Haven, Conn. Most of the thirty-seven bloodhounds I now have came from these long-lived mothers

Toughey, whose registered name is "Yaithful of White Isle," came from this stock, He got his nickname when he was a puppy and swallowed a wree express seal. Sometime later, a currous lump formed on his side. I operated on it and found that the wire and lead had worked through the stomach lining into the flesh of the dog's side. When it was removed, Toughey made a moid recovery and today, at the age of four years, is

one of my best trailers

The best time of all for trailing is on a root, damp might. The worst is on a hot, dry day when a strong wind is blowing. Often, on damp winter nights, I find all my hounds restless, pacing back and furth in their pens, amifing the air. Conditions are perfect; if they are taken out they trail like demona. It is at such times that dogs have made record runs, following trails a hundred bours old or older, in many cases.

ON GOOD according days, the dogs may run as much as fifty yards to leeward of the vizit the wind carry on the scent to them. I remember one time taking a pair of s most does on a training run about duck Ash sigh I knew the box who had laid the trait had run along the top of a ridge the dogs, with noses to the ground, ran along the vasiev pursued to the ridge top. The cook evening air was descending into the valley carrying the scent with it. When they came opposite the tree in which the runner had tudien, they turned instantly up the slope toward him

is training puppers. I wouldy wast until

they are a year old before starting the work Refore that, they are too scatterbrained to get much out of it. Recently, I have been testing out a new system of preliminary training for

young dogs.

Several boys line up, and after rubbing Ever on their hands, put them behind their backs. All have the liver smell, so the dog can't tell which really holds the meat. Then I give the dog a soul of clothing belonging to the boy with the meat. If he goes to the fight one he gets the aver if he doesn't he gets a scap on the none. This training teaches the jup to associate with something pleasant. the job of trailing a scent to the right person. All during the early stages of the training, the dog is rewarded at the end of the trail, and, even later on, the older bloodhounds get rewards occasionally to sumulate their

THE second step in the training is follow-ing a short trail. Neighborhood boys lay the trails for a sickel spiece, and have the time of their lives trying to fool the dogs. There are two half mile trath on each training trip: one out and one back. Four times a week for about two months, the young does get the workout. As they gain in ability, the trails are increased to four or five

The boys carry strips of newspaper, and tear off bits every few yards to I can follow the trail and know if the dogs go satray During the later stages of the training, If they get off the trail, I flip the strap with which I hold them and the short section of thats attached to the harness slaps them on the back. This is a signal they understand and they instantly circle back

threasonally, the dogs get a practice run that bu't on the schedule. Recently for example, one of the bloodhounds got its foot in a heavy trap set filegally in the woods near New Haven. Taking another dog, I made the rounds of the trap line, taking up the traps and following the trail right to the door of

the man who set them

Because, in their later work, the dogs must meet steamer sights and sounds and smells, I make it a practice to carry on the last stages of the training under varying surroundings They are taken by car to different locations At the scene where the trail has been laid, I unemap the holding steap from the dog's collar and snap it to the harness ring. This is the signal to go. Afterwards, I never let go of the strap. If a bloodhound is allowed to run loose, it will soon outdistance you and may get lajured

Most of the later training trails run through same preserves. Puppies will turn off and follow fresh rabbit and for trails, but the older dogs pay no attention to them. In fact, I have seen rabbits leap out almost under their noses without attracting more than

passing interest.

N a long trail, the dogs have to be stopped by main force, occusionally, In give them rest and water. If left alone, they would work themselves to death. A classic example of a bloodhound that followed a trail to death is Dr J H. Fulton's famous dog Jo-Jo.

When a long series of burglaries buffied the police at Pueblo, Colo., Jo-Jo and her mate, XRay, were given the job of tracking down the thief. The trail led out on a high trestie over a river. The dogs and the man handling them were half way across when a train swung around a curve and rushed toward them without slackening speed. Unable to attract the engineer's attention, the man leaped

thirty-five feet (Continued on page 101)

AMAZING FEATS OF BLOODHOUNDS

Continued from page 100)

into the river below, dragging one dog with him. But he was unable to budge Jo-Jo She continued on the trail until she was tundown and killed.

These same dogs, during one of the early years of the present century, followed the longest trail on record. At Onesda, Kans., a burglar made his get-away with a horse and buggy. A currycomb used on the stolen animal gave the dogs the scent, and they set out after the horse. With short pauses for lood, rest, and drink, they followed the trail from Wednesday morning until Friday night At Elwood, Kana, 135 miles from Oneida, the bloodhounds got their man

IN CONTRAST, take the shortest trad ever run—ten feet. It saved the lives of three children. An insane woman in Kentucky had ned her children up to a chicken coop while she sharpened an ax to kill them. They were found in time and the bloodbounds of Captain Musikin smilled the ropes with which the children had been tied and walked ten feet to the woman. She confessed what she had planned to do and was confined to an institution before she could harm the children.

At the end of the training period, before I sell one of my dogs, I give it a severe test to make sure it can hold the trud. Early in the morning, a boy lays a five-mile trail that ends in a sizzag run across a New Haven golf course. Twelve hours afterwards, when players have been tramping over the growns and fairways all day, the dogs have to follow the trail to the end. Once, on an evening after 1,000 people had been on the course watching a tournament, a dog accomplished the feat without apparent difficulty

Every once in a while, a chase ends in a comic climax. I recall one instance of the kind which occurred several years ugo. A lost person was thought to have gone through a gate near a brook. We put the dogs on the trail. They run to one pool, rigragged about, and headed upstream to the next pool; there they repeated the performance. For a mile and a harf, we worked upstream, circling at every pool. We had come to the conclusion the lost person must be fishing, when the dom aghted their quarry, two photographens making scense pictures along the brook!

When I give a bloodhound a piece of cluthing or an object to smell, I take pure to be sure that only the person wanted has worn or handled it recently. Once, when I was just begenning with the dogs, I let them said a doll belonging to a lost child. Without any preliminary circling, they started off down the road at top speed. At a neighbor's house, they ran to a sister of the lost baby. She had been the last to play with the doll.

THE professional fee for trailing with bloodhounds is fifty dollars for taking the dogs out, and seventy-five dollars if the hunt requires more than one day. I have never heard of a single trail being followed for more than two days. Probably the largest check ever tashed for bloodhound work was given to Captain Mullikin by a coal company in the South; it was for \$5,000 and represented three months' work in running down a gang of wreckers. On another occasion, the Cuban-Government hired Mathkin for six months to trail assassms.

According to statistics, there are only 167 owners of registered bloodhounds in the country. The total number of pure-bred ammals available does not exceed 400—the total of trained dogs, under 100-far too few when their value is realized. An important advance in the future is likely to be a wider appheation of the amazing ability of bloodbounds for finding people who are lost

The Diesel Engineer



Diesel cogines — because of their high strick-my dependanting and enginery of operations are fast replacing stram and gasotine engines in power plants, motor triade an, buses locomotives and ships travers dredges, dress, purpose etc. opening up stearly well-paid jobs for ideach-trained men.

You can got the personny training at home on all the latest Direct developments ap-and four-grown cycles golds and archipertup the systems low- and high-speed and heavy dury types friend-electric gages me systo ele mure unfurirs all ten ma erialunderstanding of this new type of power.

Free on a chapter and the desired that he de the measure and continually expending more all seath on an long at Southerd to work. A horsy moderned his training we help him teams out all a supply adjusted to the continuation.

I supply adjustment with all over-increasing the continuation of the supply adjustment.

American School, Department DS-46, Drexel Avenue at 58th Street, Chicago

Learn to be a TAP DANCER

Why may the may chythen and faccinating group of Sirgs a Friendly, Freel, distance and a ser. Not 3 at can be be a less than 1 as a series of the angle of the an The access of the second lay does not be seen to be see

Ship Model

owners an entiry make

been ful to male model

of a rotar-roo four may ed to less fell, an indicate fell.

of fact means on a from the

stande pitter for the tyleraed.

with weighten spendamen in this bears new manual

Tricks of Experts

NUM WADE EASY FOR AMATEURS

of home who are turning a greet out that meet a far the r far to the r

that he had a price of the metric of the per process of the best of the per from 1 and 150 to be to the term of the best of th

they in the proof or make their books where their a board where the first and a to the care

tigal net annu sa sa & about e could search of h horasan. and it was answering which primps, adding about

the street of the state of the

to make any more. Such he as policy for though



Make Glazed Concrete Pottery

atored gladed contacts a part ery toude without motific power of the second Non-specific at their world discribed Non-shiped states discreted. The mind and seconds therefore plants bank-length were described in the discrete states of the second second states and the second second



Party militia

HINDS.

MARKET D

provision

HATSHAL POTTERES COMPANY 434 Boound Ave., So., Room 22 pinneapours.

Look Manly requests an incomplex of price of feathers. It prefers to prefer to the state of th

S & H Applicance Bopt, P S-1, Farnet Hills, N. T.



People 27 h-th. Handres, 1966.



POPULAR SCIENCE MONTHLY 353 Fourth Ave., New York, N. Y.



Big Profits in "Nufond Cingts"

Breeder lays x0,000 eggs (833 dozen) each year. Bullfrogs sell \$1 \$5 dozen. No experience necessary Buckyard pends start you. Any climate suitable. Get the facts on this new industry. Our big FREE book explains everything. Write

AMERICAN FROS CAMMIN

(World's Largest Free Martis) Pers. 146-9





Learn the Carlo, Continental, Rhumba, Kiss Dance, Etc.

The bases of the later with the bases are always not real and the state of the stat the interest arranged to the well that a successful a sure for and here may be a sure of the sure of t & CHAPTERS

the Continuetal, the face to be a dance to Man-butter Course, the Course Bound of Ario the butter Course by the Course Bound of Ario the Course of the Course Bound of Ario the Low of the Ario to the Course of the Second of the plant of a superior of the post based of plant of a pure is come and the common the prince 30 course by have posteriors works works to Co., Book 191, RACARE Will.

Buy this beautiful long-pow Bi-ming on Posts his but it did not draw factory for neity the u-dice. Business it work hardward standard will arthuge man-gist whome on hep-leved busin queen ap-topping of hep-topping of distribution and

ATENT

Send drawing or model for examination, WATEON E. COLEMAN, Patent Lawyer 724 North Street Washington, D. C.



PROFIT BY ORS STRONG PATENTS

to have a real engagement to have equipment of a color of the color of

J. J. O'Brien - One II Transferent and September Symbol 300 West 63nd St. Wh. 7-6300 New York City

Inventions Promoted

Patented or Unputested, In humaness ever 34 years fland drawing and description or model, or were for information. Complete facilities. Raforonces.

ADAM FISHER COMPANY St. Louis, Me. 183-D Enright,

Patented or Lingalented

If you have a sound, practical investion for sale, patented or aspatishted, write

Chartered Institute of American Inventors Dept 3C Service Sethling, Washington, D. C. World's Largest Department of Inquitory

U. S. PATENT NO. 2,000,000

(Continued from page 13)

placing the engine in a casing semulating a horse. This "horse" was mounted upon whech which were driven by the engine and to preserve the old order the vehicle was controlled by mumerous reins.

In its breader aspect, the Patent Office is the greatest scientific and mechanical library in the world. Like any library, the Patent Office offers its records to the inspection of the public, but is unsque in that it maintains in print copies of the entire 2,000,000 United States patents, which are offered for sale at ten omes each. It also supplies photographic copies of foreign patents, publications and the like, at nominal cost. The yearly demand for copies of United States patents amounts to 7,000,-000; while approximately 978,000 photostats of foreign patents and publications are furnished. In this respect, the Patent Office is the greatest "dame store" in the world.

WHILE the Patent Office is the world's greatest scientiale and mechanical fibrary the public too frequently loses sight of the fact. A short while ago-and it is an everyday occurrence—un applicant appraied to the courts from the refusal of the Patent Office to grant him a patent on his alleged invention. At the trial this applicant stated that he had expended two years in inventing the device of his application. The court rephed. "We think that the patents to which we have been referred by the examiner, if consulted by the applicant, would have taught him how to overcome he difficulties." This inventor had not employed the Patent Office for its greatest purpose, that is, as a library where one may obtain all the information per-

taining to any eclentific subject

Nor do manufacturers far excel the general public in making proper use of the library. A few have patent departments, but the majorit just drift along until they get into a patent ram," whereupon patent lawyers are emthrough a large acid plant operated by one of our leading fertilizer companies, I asked my guide whether their chemists used the Patent Office to keep posted on new developments and improvements in sulphuric-acid musu-facture. He replied, "There hasn't been an improvement in sulphure-acid manufacture since Cas Lussac. A short time afterwards a superintendent of this same plant came to see about tertain new and valuable discoveries be thought, he had made in sulphuric-acid manufacture. To his amazement we found his idea had been patented more than fifty years be-

N THE cases just recited, the parties had overlooked the fundamental purpose of the Patent Office, as a library for the use of industry. Let me repeat, the real object in mtablishing the Patent Office was, in the words of the Constitution itself, "promotion of science and the useful arts" for the benefit of all mankind. Primarily, it contemplated the establishment of a huge storehouse for accumulated accentific and technical information. This purpose is too often last sight of by reason of the incidental reward offered the inventor in the form of a muent. Obviously the drafters of our Constitution would never have troubled themselves for the simple purpose of aiding sporadic investors.

hach new idea is the seed of hundreds, sometimes thousands, of subsequent patents covering improvements, refinements, and varsations. The ordinary person can recite at least 100 improvements that have been introduced in the automobile in the last ten years. There are far more inventions, however, made in machines, processes, and alloys used in the manufacture of automobiles than there are patents covering the automobile itself. One

oil company holds more than 1,200 patents and applications covering developments in an ou-cracking process! It is due to such step-bystep developments that second-rate gasoline of today compares favorably with the high test motor fuel of a few years ago. Similarly, the first crude concept of a cash register has furnished the basis of several thousand (witcht)

In the development of the linetype, one man, the late John R. Rugers, patented more than 500 improvements. Rogers was induced by his brother to become a printer, "This is a good, safe job, the brother said. No machine can take it away from you." The inventions of Rogers never took away jobs. He actually made more and better jobs, though be changed the nature of the work. In developing another field, Carlton Ellis has been granted 601 patenta, mostly on chemical compositions, lacquers, paints, and paint remov-

ELIHU THOMSON, one of the founders of the General Electric Company and a revered contemporary of Edison, has devoted his life to the development of electricity, Up to date, he has been granted more than 700 patents, each marking one step, along the road

to mechanical perfection When one reads that Thomson has been granted over 700 patents, Edison over 1,100. Ernst P W Asexanderson of General Electric 252, and John Hays Hammond, Jr., 289, the conclusion is immediately drawn that profestional inventors are the chief contributors to the Patent Office, Nothing is farther from the truth. The people named are the exceptions. The great majority of our potents were taken out by sporadic inventors. Cartwright, a clergyman and poet, invented the power loom, Eli Whitney, a New England school teacher, conceived idea of the cotton gin while sejourning in Georgia; Arkwright, a barber, invented the spinning frame, H. G. Wells, the writer, suggested the military tank, and the automatic telephone exchange was the inspiration of an undertaker. The Wright brothers, inventors of the sirplane, were hicycle meclusios.

The Segal lock is a case in point. Segal was a New York City policeman. In the course of his duty he encountered numerous instances where apartments were entered by prying between the door Jamb and the door. Segal then conceived building the lock with a catch to prevent such entrance. Segal drifted into the lock business, formed the company which bears his name, and, in a relatively short time, sold his business for a price in the millions

Few inventors can produce both quality and quantity in inventions. In the final analyvis, the ability of an invention to fill a want is paramount. Some of the greatest inventors made relatively few inventions. The Wright brothers took out only five patents. Samuel F B Morse, and Eli Whitney, both appear to have made only one invention, the electric telegraph and the cotton gin respectively

"T'HE truth is, we are all more or less to-A ventors, albeit some of its are very humble ones. To say of a man that be is a good engineer, or a good plumber, is but to praise his inventive ability. Every time the carpenter varies the pule-of thumb in his dally with each time the housewife improvises something to facilitate her tasks, an invention is made. not always of a high order, perhaps, but neveribeles an invention. The first crude sharpened spear of prehistoric man drew upon the inventive faculty. The how and arrow was one of the great inventions of antiquity, while the discovery of the use of the wheel was a still greater one

(Continued on page 103) Today, one

TWO MILLIONTH PATENT

(Continued from page 102.

cannot scan the yearly index of patentees without finding the name of some acquaintance, some neighbor perhaps, or even a relative, so cosmopolitan is the roster. As one's eye runs down the list, names appear which never before were associated with inventions, Dr. Einstein patents a refrigerator, Josef Hoffman, the great peanest, takes out several patents on automobile steering mechanism, Cornelius Vanderbilt, Jr. patents a shoe-potishing cloth, and the street sweeper patented by Col. John Jacob Astor is justaposed with that of a poor unknown. The name of our great President Abraham Lincoln is democratically mingled with the names of some tinsung inventors.

URE than 15,000 of these patents have M teen issued to women. For instance Miss M E Knight invented the modern paper hag. Mrs. Martha J Coston invented the flare light used for signaling by mariners all over the world. Mes Bruigh Louise Henry sometimes called the Lady Edison, has fortytwo inventions to her credit

To indicate the universality of the inventive urge, let us consider in brief detail some one field-say athletics. Walter Hagen is known the world over as a golfer Few people, however, are aware that he has patented a golf ball having a surface design which, he states to his parent paners, makes the ball across e in flight as well as in pq the and rolling,

Rent Lacoste, the French tennis player learned much on the tenne court and lamost valued experience he has passed along in the form of patented inventions in racket structure

Sandow, the "strong man, in order to demonstrate his strength with exactitude, devised Various strength-measuring apparatu-

and patented them In baseball player-inventors are almost as common as player-managers. If you have ever seen Max Curey, forescely of the Pittsburgh Pirates, slide into a base, you may have won dered what saved his bide. Well, blax always used a special sliding pad which he himself invented and patented. This pad, his patent states, "will protect the parts of the body akely to come in contact with the mith while anding to a base, whether the slide be feet first or head first "

On the other hand, Benjamin Shibe, owner of the Physadelphia Athletics, has patented a man of inventions on player equipment, including baseballs and baseball-making machinery. It is under his patents and in his own plant that he manufactures the basis used by the American League

MARLES BRICKLEY former Harvard Cootball star and All-American fullback, is said to have been the greatest drop-kicker of all time. Sports writers attributed his success in goal kicking to his "educated" too They probably did not know that Brickley wors a patented shoe of his own invention. which deserved at least some credit for his spectacular performance

The price ring offers the same story. Bob. Fitzummons had trouble during training in keeping the punching bag properly placed. As a result he designed and patented a punchingbag support which obviated the objections be

had experienced.

These are only a few of the curious facts revealed by a study of the two million patents on record at the Patent Office, Far more significant is their testurous to the inventive genius of Americans and of the foreign-born citizens who have found encouragement and opportunity here. What will the next million patents provide for the increased comfort and safety of the race?

TRI-STATE COLLEGE

ENGINEERING DEGREE IN 2 YEARS



Crarses in Cvil, Electrical Me-an al, Aeronaut cal Radio En-pressing Essentials of engineer-guratoring included and non-ex-nuars eminated B S Degree anted appeal completion of course Trans thous ca over students.

Those who is a high school tta fing may make up required noth

Cadus of compete to costu y

with those of 4-year schools. Techral instruction at lowest cost and

in least time consistent with thorin least time consistent with thorough craining loven-size institut on in accord with end v dust as my Courses a so in Bus noss Administration and Accounting Students in mail maria of he word. To State graduates make grad Lovered in majoreaque had and lake reg on Tarrion living expenses low 57nd year Enter September January, March, June, Write for casalog, 313 Chilege Ave., Angula Ind. log. 373 College Ave., Angula Ind.

EARN JIU-JITSU



and the goal in constanting lur-a

TEAN

TO THE PART OF THE PART

WILL YOU WEAR THIS SUIT

Send for Samples—FREE of COST

HELP INVENTORS

Worth While Ideas Protect, Patent and Scil Free Information

GUARANTEED PATENT PROTECTION CO. Grand Control Polace. New York City.

Book of FORMULAS

t unnderint manual m you and intermation that a hard to find when you

peed it. For bosschold shop, laboratory Formulas, recipes, methods and secret proceven Make your own beverages, glors, cements, cleanets, polishes, examels, paints, cosmetics, diets, inka, toothpastes, maps, silver and nickel plate, metal alloys, photo chemicals, oils, lubricants-and scores of articles for home use or for founding your own business through making and selling. Full cloth bound \$1 00.

POPULAR SCIENCE MONTHLY 361 Fearth floor Number of Ta

Are you adult, alert, ambitious, willing to study ! Investigate LAW! We guide you step by stepfurn shall tests, including 14-volume Law Library Framing prepared by leading law professors and given by members of har Degree of LL B. conferred. Low cost, easy terms. Send NOW for Free, 64-page"Law Training for Leadership."

Lafallo Extension University, Boyt. 763-L. Okicago

FIREWORKS

ASSORTMENTS OF FIREWORKS BEST SOLD Fee \$1.00-\$2.00-\$3.00-\$19.00 and up

professional August Aug

A. WOLLMAN, INC. 703 East New York Avenue

Established 1988 Brouktyn, New York LARGEST DISTRIBUTORS OF FIREWORKS

Learn to MOUNT BIRDS



H. W SCHOOL OF TAXABERRY, 5-230 Smet Side, Oracle, Nob.

OPPORTUNITIES



Home-study courses in Migh Spend Biosel A SHALL

Telectaina Eng., Atest ejerekaklikeil reugrace.

In every combine of

CANADIAN COLLEGE OF SCIENCE - TETH 100.0 I

Supt. P. B., 219 Bay Mr., TORONTO - CANADA Proof American all alternative Planting for the China China and the American Landon & all and

Always mention Port LAR Science MONTHLY when answering advertisements in this magazine.

TRAVEL FOR "UNCLE SAM"



Phony Early Experimettes

Start \$158.00 a Month MAIL COUPON BEFORE YOU LOSE IT

FRANKLIN INSTITUTE, Dept. 5273 Rechester, N. Y.

The Mark to me william charge copy of 50 pages.

Long and to their of the company halo, a the

to of positions and potated of ing time to get

Address

-C. P.---**CHEMICALS**

Chemically Pure Chemicals and by place continuous—uncombinously pur-mited SET IN DIS OLY SALES New bargains' Save money in the CHEMPCALE and APPARA-TOE for your batter laboratory—buy first from our factory. To make now briends nor influshio chemical and space of orenthings are offered below cost SEND or in atomic Get your capter NOW.

KEMKIT CHEMICAL CORP. Breeklyn, N. Y. 136-A Johnson St.

Never a Dull Moment with CHEMISTRY AS A HOBBY

To pre-approxi-on a hopey yet here) by the form former and the state of the state of the part of the state of The bright problem from tradition to continuous and the problem to the problem to

W. Y. BIBLOWICAL DAPPLY OF 1804 18-113 S. 22 St. H. T. Chp.



CHEMICALS

Apparatus and Glassware Send 34 for Catalog CP1

BIOLOGICAL SUPPLY COMPANY 1170 Mt. Hope Ave. Rechector, M. Y.

PATENTS Interpretation to the part of the

few days in printering your ideas, or the slightest carrieds from a hamiling rour paints papers may easily be very cost y. My personal active empire aperity active and attracted coefficience. Send interchataly for my five H-page bankiel. How to test You Pales.

L. F. Randelph, 340 Victor Bidg., Washington, D. S.

PATENTS-TRADEMARKS

All laventions substitued held confidential and given personal strention by members of the first Form "F intense of Comseptions and in tractions "How to Kitablish Your Rabis FRIE

LANCASTER, ALLWINE & ROMMEL PATENT LAW OFFICES

Always mention Popular Science MONTHLY when answering advertisements in this magazine.



CARL MILLER
REGISTERED PATENT ATTORNEY
FORMLA MEMBER LAMINING CORPS 9 5 PATENT DEPARE

1636 Woolverth Bidg., Dopt. 15C, Now York. MALER BUILDING, BEPT 75C. WASHINGTON, B. C. Philosoph desired and patter Frank Blanks, "Reper to Militaria is Park-and," and "Military and an improvides France,"

MAME

ADDRESS

ENTERTAIN YOUR FRIENDS WITH CHEMICAL TRICKS

(Continued from page 45)

property. Divide some of the liquid between two test tubes, adding a drop of hydrochloric and to one and a drop of sodium hydroxide solution (lyn water) to the other. Now stand the test tubes where they will not be disturbed, convenient supports are large, fial corks bored with holes in which the tubes may be inserted. After about twenty four hours, the clay particles in the acidified tube will settle out, leaving a clear liquid, while the clay in the tube containing alkali will not settle out for days or even weeks. The partiries in the sodiam hydroxide solution are bebeved to become electrically charged to that they repel each other and hence do not tend to gather at the bottom of the tube. This experiment will often work with other lands of clays, and the experimenter may find it isteresting to try these found in his locality

A NOTHER chemical trick that not only is amusing but demonstrates a property of water glass (sodium silicate) is the manufacture of "chemical ice."

Pour some water glass solution into an ordinary tumbler and add to it some muriatic acid. In the reaction that follows, a stiff white, sandy precipitate will be formed that will adhere to the glass and have all the characteristics of a chunk of partly-frozen ice Because it is difficult to remove the "ice," once it has formed, it is best to use an old relly glass for the experiment. If this test is performed in a test tube, it will be necessary to throw the tube away when the experiment is completed

The white substance formed is suicic acid If heated in an open flame, it will be tramformed into pure silica or white mad

Incidentally, a bottle of sodium suicate provides a bandy cement for use around the home isboratory. In its concentrated form, known as water-glass strup, it can be used for cementung glass, cardboard, and many other substances. As a matter of fact, it often in used commercially as an adhesive in the manufacture of corrugated boxes and large cartons

Hy using two sample chemicais, who can make a novel solution that is so beasy that it will float stones and other heavy objects To prepare this high-gravity liquid make a strong solution of potassium lodide and saturate it by dissolving in it a large amount of red mercuric todate. The resisting solution will be more than twice as heavy as water A vial of the liquid, with small stoom floating on its surface, forms an interesting currently for your laboratory shelf. Be sure, however, to use a strong solution of petassium locade and plenty of mercuric lodide. Also, since the solution tends to attack metals, it is best not to attempt to float range or other objects made of valuable metals on the liquid

NEW CHEMICAL METHOD FOR AIR CONDITIONING

A NEW way to take the humidity out of the air in a home or building recently reported to the American Chemical Society, as to draw the air through a spray of lithumchloride solution. The chemical absorbs the excess mousture, and may be re-concentrated by boiling whenever it becomes too diluted Because only a small amount of electrical power is required, the new air-conditioning method is declared theaper than removing the humshity as dear by chilling the air If it is peressary to cool the six as well as to dry it this process is made much easier when the air is precined. The efficiency of an air conditioning system using refrigeration is increased two and a half times by predrying the air by the chemical method.

HERE'S THE ANSWER

(Continued from page 48.

distance. Fishermen will tell you they have often seen stubborn fish back away from the

It Gives Them the Willies

H E. A., PORTLAND, ORE. IN AMERICA, ROY violent wirk storm such as a cyclone or a hurricane is called, in common speech, a willy-willy." This expression is said to have been taken from the language of the Negro

The Teeth of a Lion

Q —without does the dandelton get its name?

-L. J., Bughamton, N. 1

A .- THE name of the dandehon is said to come from the peculiar shape of its leaves. The French called the plant "dents de lion" or "teeth of the llon."

Well Dished Out

B D., PHILADELPHIA, PA. The expression "apple-pie" order was once "cap-a-pie order" and meant "armed from head to foot "

Under-Moon and Under-Sun

R. D. R., SAM PRANCISCO, CALIF. Penrshaped images of sun and moon, hanging from a ring around either heavenly body, are recognized phenomena seen most often by aviatoes flying over mist and clouds at sunrise or

Can't Fual the Boll Weevil

R N. C., toposito, our Extermination of the boll weevil is made more difficult by a peculiarity it has. Most weevils will fly late a lamp at night, but the bull weevil it not altracted by a light, although it flies in the dark Therefore it cannot be snared in lighted nets.

The Long, Long Trail

B. C. S., PITISSUMPH, PA, The longest known Indian trail was the warpath of the Six Nations, It extended from northern New England to Georgia, and was a primitive commemcalions system must effective in its day

Pick & Soft Place

Q-west kind of terrain should be sought for a landing field for gliders !-- P] M Bernardsville, N J

A --- A FIRES completely surrounded by hills.

Why the Dime?

H. E., DALLAS, THE. A ten-cent piece is called a dime became in the thirteenth and fourteenth centuries, in England, the Latin word decimus, from decem, ten, was used to describe the tenth part of one's income, in lithes. An early form of the word was dyste-The word is appropriate today became the done is the tenth of a dollar.

The Forbidden Hue

C C, saton govers, i.s. Mot on picture studios have a rule against the wear ng of dead white by performers, because white causes halation in photography. Pase yellow is gencrally used instead.

As the Grow Does Not Fly

5. G., cutves city, cally The expression as the crow flies" is a result of carriers observation. The crow rigzags considerably in

SCIENTIFIC SHOOTING GALLERY REVEALS SECRETS OF GUNPOWDER

(Continued from page 21)

is fitted, very anugly, a hardened steel piston, at the base of which is placed a small copper cup or gas check to act as a gas-sealing device. The upper end of the piston presses against a little cylinder of carefully prepared and calibrated copper - lead of standard length, which, in turn, is backed by a metal block attached rigidly to the barrel. The pressure generated by the powder gases, ruptures the cartridge case directly below the end of the piston, causes it to move upward against the copper or lead crusher cylinder and, acting like a small bydraulic press, compresses it into the shape of a tipy barrel, and, of course, reduces its length. It is a simple master then to insert the compressed cylinder between the jaws of a specially calibrated micrometer and read off the pressure directly on the dial. The bullet, in the meantime, travels out of the barrel in the usual manner, with a very slight decrease in velocity due to a small loss in gas pressure from its action on the piston.

THIS is the method used in routine tests.

When research problems are being puraued with utmost exactness, a more descate and accurate method is used. Quartz crystals reptace the lead or copper trusher cylinder It is a well known property of a properly cut quartz crystal that, when auddenly compressed, a generates electricity. In the pressure test, the quartz piezo-electric crystals are connected to a cathode-ray oscillograph so timed that a record is obtained of the electric current generated when the piston furced outward a more few thousandths of an Inch by the expanding powder gases, causes the crystals to be compressed. From this record, not only the pressure in pounds per square inch can be determined, but also the rate at which it was developed

Velocities of bullets are measured by a deficate electrical device, called a chronograph, which operates on the principle that the acceleration due to gravity on a free-falling body is a constant and well-known value. A bullet, immediately after leaving the mustle, breaks a fine copper wire carrying an electric current. When it strikes the armor-plate target, it causes a metal ball, resting in a V-shaped groove, to jump into the air, breaking the circuit between the two in-

sulated sides of the groove

Back in another room of the laboratory, the breaking of the wire causes a magnet to release an iron rod sheathed in copper and coated with lampblack. When the builet strikes the target and the metal ball jumps into the sir a second rod is released. As it falls, it strikes a trugger that releases a knifelike arm which makes a mark on the first falling bar. By measuring the distance between this mark and a previous calibration mark and making a calculation using the acceleration of gravity and the known distance over which the builet traveled, the exact velocity of the bullet can be determined This, of course, is the average velocity between the cross wire and target, and not the absolute velocity at any given point. The velocity at the muzzle, or at any other posm, can be calculated with reasonable accuracy from this value. For extremely accurate measurements of velocity under research-laboratory conditions, equipment employing photo-electric cells instead of mechanical circult-breaking devices is used.

MODERN smokeless powder, made with guncotton as a base, is used in a great variety of shapes. Some foreign countries are a form of powder that looks like strips of thin wood. Practically all powder used

in the United States is either in the form of flakes, small grains, or cylinders carrying one or more perforations, the type used depending on the service it is required to perform, Guncotton, which the chemists call mirrordjulose, and other ingredients are mixed with ether and alcohol or similar solvents, and presed through dies to form tabes or rods which are cut into desired lengths. Through the length of the grains extend tiny holes, from one to seven, depending on the grain Size. The size and specing of the holes are unportant, for they determine how rapidly and effectively the powder will burn. Smaller grains have a tendency to accumulate charges of static electricity, which might cause accidental ignition. Therefore, the grains are given a thun coating of fine graphite, which short-circuits each grain, and prevents the accumulation of a charge.

NITROCELLULOSE in its pure state is unfit for use in firetrus. It has to be toped down by certain materials known as deterrents. These absorb heat rapidly, and so slow down the rate of burning and consequent generation of gases. Incidentally, these deterrents also reduce the tendency of the powder to alworb monetaire.

Smokeless powder actually undergoes a water-steeping treatment at a late stage in its manufacture, after which it is dried and made ready for use. Likewise, at army depots, smokeless powder not peeded immediately often is stored in concrete tanks dooded with water. When it is to be used, it is removed and dried, the latter process requiring a week or so. Similarly, powder is kept, in some parts of the world, beneath mountain-lake waters, where low temperature and moisture combine to prevent accidental ignition

An incident that occurred during the World War serves to demonstrate further the water-proof qualities of nitrocellulous powder. A ship tarrying a cargo of this explosive for one of the alised nations was such in the Black Sea. The enemy, knowing the location of the number vessel, later salvaged its cargo and used the powder with perfect success.

The performance of a modern rifle or pixtof cartridge is more than a matter of powder composition. The density of loading, size of powder grains, type of primer, size and shape of bullet, manner of crimping (folding the edge of the cartridge case inward to confine the charge), and the material of which the cartridge case is made, all are important and must be balanced one against the other for best results.

WHEN it was first decided to manufacture high-speed ammunition for .22-caliber rifles, a larger quantity of higher-powered powder was loaded into the regular copper shells. It soon became apparent that stronger cartridge cases would be required, therefore, brase had to be used. Frequently, highvelocity ammunition is loaded with a doublebase powder; that is, one which contains both extrocellulose and nitroglyrerine

If there is a lesson to be learned by the gun fan in the work being done in the modern powder laboratory, it is that smokeless powder, which means most of the powder used today, is not the simple thing that he had imagined it to be, behind its dependability is a vast amount of scientific research, study, and constant testing. He would learn that the use of non-corrosive primers, which do not deposit metal-rating potassium chloride in the barrel of his gun, will save him hours of labor and, with occasional cleaning, will keep his gun in good condition



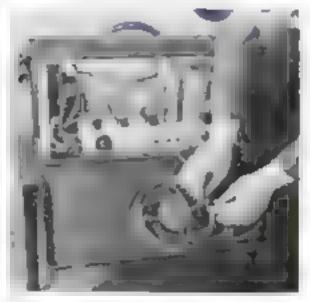
BUILD THIS PORTABLE PUBLIC-ADDRESS SYSTEM

Continued from page 35)

have to be fussy about hotels to appreciate Hotel Cleveland • But if you are, you will







When not in two, the microphone can be mored in convenient clips mounted inside the cover

of maintaining its inductance rigidly at 150 miliamperes current. The dynamic speaker field (1,200 ohms) serves as the second choke.

The power-bleeder resistor should have a resistance of 7,500 ohms, although a 10,000ohm unit can be used without causing difficulty. In any case, its rating should not be loss than fifty watts, and preferably seventyfive watts. Cathode resistors for the two type '76 tubes should be of the two-watt variety and the 250-ohm resistor in the negative high voltage lead should be rated at twenty-five walls. This last resistor also should be provided with a tap at 130 ohms,

Care must be used in wiring the 12-mid., 150-volt electrolytic condensers into the circuit. The positive lead of the condenser, in each case, should be connected to the ground.

As to the voltages, the three type '42 tubes triode-connected) should have a positive plate potential of 380 volts, measured at the tube socket and the current abould be approximately twenty-five milliamperes to each tube with no signal. The two type '76's should have a posture plate potential of 200 volts measured at the tube socket with a plate current of approximately five milliamperes The rectifier plate voltage ahead of the filter network should be 420 volta. A transformer delivering 350 volta will be large enough. provided that an extremely low-resistance B filter choke in used to ariow at least 300 volts at the plates of the '42 tubes

The purts required are as follows

Condensers Three 8-mid., 500-volt, electrolytic One 12 mid., 140-volt, electrolytic Two 12-mid., 25-volt, dectrolytic Three S-mid., 600-volt, electrolytic Two 25-mid., 400-volt, paper Two Q1-coid., tabular

Three 60,000-ohm, 1-watt, carbon Two 50,000-ohm, 1-watt, carbon Two 150,000-ohm, 1-watt, carbon Two 100,000-ohm, 1-wall, carbon Two 000-ohm ! watts, carbon One 250 ohm. 25 watt, wire wound One 1 500-obro, 75 wart were wound One 250,000-ohm, volume control

Trensformers. One 500-ohm line input tapped at 200 One class "A Prime" push-pull input One push-pull output for triode '42's One power transformer, 8-0-volts, centertapped at 420 volts, 150-MA rating One B-filter choke, 10 henries at 200 MA

Muscellancous Tubes, sockets, wire, switch, knobs, speaker, line cord, chassis, leather-covered case, parts,

TRICKS THAT ADD TO DRIVING COMFORT

(Continued from page 56)

personally," Gua agreed. "But it does show what I'm driving at. The point is that some change in the regular arrangement may help. Take the cushion that supports your back. Sometimes, building out the padding near the bottom, or perhaps half way up, or even at the top, will make the cushion a better fit for your particular type of anatomy. At any rate it certainly is worth trying. You don't have to tear the cushion all apart to find out, either You can hang a thin, water-edged pad by strings from the coat rail at different heights just to try out the idea."

"SOUNDS reasonable. I'll make some tests when I have the time, said O Hara, interestedly, "Still, I don't think it will do much good. No matter how comfortable the driving position is, I'm always dog-tired at the end of a long run, and that's pretty often, You know how much I'm on the road"

"All the more remon why you should try out all the possibilities," Gus advised. "But, as you say, a driver can get tired even though the seat cushions and the position are per-

I'll say he can," O'Hara grumbied, "You and a lot of other drivers get thred on long trips because you don't know how to rest yourself while you're driving. I've watched you, and you always sit in exactly the same position with your hands resting on wheel in exactly the same places, and your feet always out so. Why don't you work out some often before you've stayed long enough in one position to get all cramped? I don't care how confortable your first position may be-you ought to change now and then. Staying in one position without any movement, even for half an hour, is harder work and more taring than ditch digging."

"I don't see how you can get much of a change in driving a car," O'Hara protested. You've got to have your hands on the wheel and your feet near the pedals, haven't

You do unless you want to give the insurance adjusters a workout," laughed Gus. "But you can make at least a couple of dozen

shifts without risking your neck.

"Look," Gus directed, sitting down in one of the office chairs. "You can sit up straight like this, or you can stump down for a while to move your spine and keep it from freeting.' Slumped down in the driver's sent is no way to drive for long, but it's fine for a short change became it puts to many joints in a new position. Then, you can hold the wheel with both hands up near the top of the rim That pulls out your arms and changes the strum on a lot of muscles that may be getting tired from holding the rim quite close to you, as you usually do.

AND, there's two variations that help to throw strains first to one side and then to the other side of your body. I mean with one hand up and the other down-like this. kou'll see lots of second-hand cars with the wheel worn only in two places. The birth who owned 'em never got wise to slufting their

band positions.

"Of course, you can't move your left foot very far and still keep it handy to the clutch pedal, but it will relieve the stiffness to pull it in close to you every little while to ease your knee joint and your hip joint on that nide as well. Don't forget that you can do the same thing with your right foot if the car is fitted with a throttle control on the steering column. You shouldn't try hand control of the throttle when you are in traffic, but it works well when you're out on a long stretch of straight road,"

Thie One LABN-GLL-042C

NEW STUDIES OF BONES SHOW HOW WE GROW

(Continued from page 15)

baby was two, her father had deserted his family. The resulting turmoil in the brokenup home had left its indelible mark upon the bones of the child,

From an examination of a skeleton, or an X-ray picture of a living person, Dr. Todd and his coworkers can decipher many of the main events in the health-history of the individual. Knowing how the body develops, they can name the time when injuries occurred.

HEIR tests have shown that some parts of the body grow faster than other parts and at different periods. Before adolescence, for example, almost four sevenths of a child's growth is in its legs. This explains why so many boys and girls are spindle-legged. The head, on the other hand, is one fifth adult size at birth, two thirds adult size at the age of one year, and four fifths adult size when the child is six. The vestibule of the eac, which controls body balance, is full-sized at birth.

After adolescence, the legs grow more slowly but the growth of the trunk speeds up. When anything upsets bone development in either the period before adolescence or the period after, a below-normal stature results. Achondroplastic dwarfs, with trunks almost normal length but with legs only half as long as they should be, show the effect of interference with bone development before adolescence. At the opposite extreme are those with underdeveloped trunks and long legs. Their arrested development came after adolescence.

Another significant thing noted at the Brush Foundation laboratory in the fact that the eye, which to the anatomist is part of the brain, reaches full growth at the age of from four to six. This is why children often look big-eyed. It also explains why persons whose facial growth has been interrupted have large, Maring eyes.

The fact that there are periods of maximum growth for each organ and area of the body offers a new technique for the analysis of discase and for determining the physical history of a patient. As part of the investigation work at Cleveland, Dr. Todd gives a series of lectures to the fathers and mothers of the children who cooperate in the experiments. The X-ray negatives in the file also guide the mothers in regulating the child's diet.

Almost as soon as the child is born, its first incasurements go into the record. The depth and breadth of its head, the length of its legs, and a score of other measurements give a picture of its physical start in life. This is supplemented by negatives made with the X ray.

FROM then on, the child is measured and radiographed at frequent intervals. Every variation in size, every change in rate of growth, is noted by the experimenters. Thus, over a period of years, they build up a complete fact-and-photograph-record of the child's development.

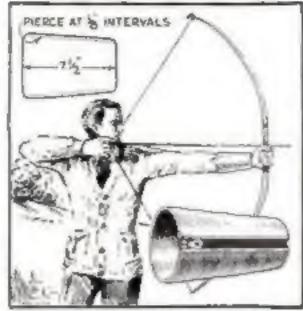
In addition to having his internal anatomy photographed and his outside dimensions taken periodically, the child is persuaded to "draw a picture of the man" by demonstrating traits in various psychological tests. He assembles hose clamps and bicycle bells to discover his mechanical ability; hange mussbered cout checks on hooks to show his muscular control; pokes needles into holes in a disk to demonstrate his steadiness of perve.

Out of this accumulating mass of records. the scientists at Cleveland hope to evolve information aiding millions of children to a

heritage of better health.

Thus, the arc lamp of Charles Francis Brush, after illuminating thousands of city streets for five decades, is playing a part in throwing light upon something vastly more important, man himself.

NEW FASTENER IMPROVES ARCHER'S ARM GUARD



This archer's arm guard is easier to put on than the ordinary type with laces or buckles

ACING the conventional type of archer's arm guard, or bracer, is always a difficult job. This trouble may be overcome by using a fastening of the familiar and easily

obtainable sliding type.

Obtain a suitable piece of heavy leather and lay out as shown so that one end is a snug fit just above the wrist joint and the other a fit for the muscles of the forearm. Allowance should be made for whatever clothing is to be worn while shooting. Cut the piece carefully and soak until soft. Pierce the slanting edges every 1/4 in. with an awl and to each sew one part of the fastener, arranging it to work from wrist toward the elbow when closing. Put the bracer on while wet and leave until it has dried to shape; then wax and polish.- JACK HAZIARD.

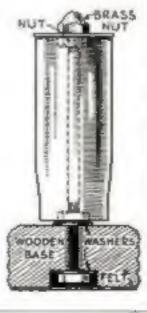
DINNER GONG MADE FROM OLD WAR SOUVENIR



ANY World War veterans have empty shells from the buttle front stored away in some hox or corner in souvenirs. One of these shells, if polished and mounted on a wooden

base like the one ilhistrated, will make an attractive dinner goog. In spite of its smallness, this gong nves a mellow tone that is loud enough for the average house.

The size of the base and the supporting bolt will depend, of course, on the size of the shell to be used. Select a good piece of hardwood for the base and turn it to any desired shape. After varnishing or otherwise finishing the wood, glue a piece of felt on the bottom - J.P.K.





bet, someone cler may be thinking atong the same does that you are; and the Parent Laws favor the pure who files his application for a patent first. Delays of even a few days can sometimes mean the land of a patent. So fram the inportant facts about Patent Protection at once.

36 Years of Preven Service

For thirty-six years, this capable organization has served dependent from all over the country. Our large staff of patent specialists given you expert and prompt service. Our fees are reasonable; we also help with deferred payments.

The couper makes it con-



A 1 C 1 E II

REGISTERED PATENT ATTORNEYS

Street 1916-C Covery Stip., Chicago, 1907-C Western Park, 216-C Empire Stip., Philadeogle, 1916-C Steet Park, Philadeogle, 1916-C Steet Park, Lin Supplies.

Send me PREE ruples of your books. "Paint Pro-tertion and "When and How to Self an Investion." "Note: Same backs supplied by one of branch offices

Nume		
Street and Na.	-	-

City or Youn

Strange Pranks of the Air Currents

(Continued from page 30)



When static electricity, caused by send erorms, interfered with automobile ignition systems, resourceful motorists "grounded" their cars

ered the surface of water in rain barrels and pools. The mysterious, glowing dust was highly inflammable and, according to imaginative speciators, burned with an odor like sulphur. We now know that instead of being brimstone and a manifestation of the devil, the particles were simply the pollen grains of a certain variety of pine tree.

Spores and seeds, as well as polles grains, ride the breezes and thus play a vital part in spreading plant life over the surface of the earth. Hay, grain, and other farm products have been carried aloft and dropped at distant points. And, diatoms, rotifers, and the eggs of small creatures are known to make long Journeys borne by the wind.

None of these heavier-than-air objects, of course, "float." They are continually falling. The only reason they stay aloft is that they are caught by currents of air moving upward faster than the objects are dropping. Like gliders, they sone through the sky supported by rising columns of air.

At Lawrence, Kans., Providence, R. I., and other places, fish have failen from the clouds, The simple explanation offered by science is that the fish are carried aloft by waterspouts and are transported overland by the swirling currents of the upper air.

Not long after the Civil War, a rain of reptiles frightened early dwellers in Minnesota, Careful descriptions of the living treatures which dropped from the clouds have enabled zoologists to determine that they were the larvae of newts. Where they came from is still a mystery.

FROG rains are also on record, one having occurred at Windham, Conn., in the last years of the nineteenth century. The small animals pelted down in the midst of a rainstorm. A short time afterwards, a shower of tadpoles took place in New York City, handfeds of the black, wriggling creatures falling on Fourth Avenue, Small touds have also been carried aloft and dropped during storms.

How far and how fast air currents flow through the sky, bearing their strange freight, has been demonstrated dramatically on a number of occasions.

In 1918, for instance, a great forest fire

swept through the woods of upper Minnesota. Dense smoke rolled eastward and in a southerly direction. The smoke and cinders possed Duluth, Minn, in the evening and arrived over Indianapolis, Ind., the next morning. By evening it was over Washington, D. C., and Western New England By the next day, it had reached Georgia and the following morning was reported from Texas.

Even wider was the spread of the cinders sent aloft by the great Chicago fire in 1871. Charred particles fell in the Azores Islands forty days after the conflagration. And, in the carly Nineteenth Century, when volcanoes in the Sunda Islands, near Sumatra, exploded like great bombsheils and hurled thirty-six cubic miles of rock, dirt, and dust into the times. They resulted in lurid sunsets and made 1816 famous as "the year without a summer." The curtain of floating dust cut off so much of the solar radiation that people in New England wore overcoats in mid-July.

The quietest air in America is said to be over Roseburg, Ore. For an entire year, Weather Bureau instruments there showed the average speed of the wind to be only three miles an hour, Chicago, "the Windy City," had a yearly average of fifteen miles an hour, and New York even more-seventeen. At the opposite extreme from Roseburg is Point Reynes, Calif., a small peninsula jutting out into the Pacific north of the Golden Gate, where the winds have the highest average of any recorded by the U. S. Weather Bureau,

Atop Mount Washington, N. H., last winter, lonely scientists recorded a 231-mile-anhour gale, the fastest moving air ever timed with accuracy. Electrically beated anemometers, functioning perfectly in the bitter cold, made the feat possible. Fifty years before, observers in a low stone house, chained to the rocks, had recorded a 186-mile-an-hour wind near the same spot.

Of course, in hurricanes and tomadoes the wind attains the highest speeds of all. No one has ever timed the rate at which the air spins in the deadly funnel of a tornado. Calculations place its speed at 500 miles an hour.

IN THE grip of such winds, the most fantas-tic of all the air riders take to the sky. Church steeples, timbers, sheep, men, houses, are all sucked aloft by the spinning cones.

At Beauregard, Miss., some years ago, a piece of iron weighing 675 pounds sailed through the air for four blocks and in South Carolina a 600-pound timber, forty feet long, traveled a quarter of a mile. In Southern Illinois, a twister picked up a house roof and carried it like a piece of paper for fourteen miles. Farther on, it wrenched off a high church steeple, sucked it aloft and transported it, sailing through the sky, to a spot almost lwenty miles away,

In Missouri, a bridge that weighed 216 tons, was lifted from its foundation and hurled into the river, a tangled mass of wreckage. At another point, the same twister followed the course of a stream for several hundred yards, sucking all the water into the sky and leaving the bare bed of the stream ex-

What is probably a world's record for tornado activity was set in February, 1884, Between 10 a.m. and midnight on a single day. sixty toreadoes left a trail of destruction across central and southern states. For fourteen hours, the wind ran amuck. At the end of that time, 800 people had been killed, 2,500 had been injured and 10,000 buildings had been destroyed.

THE most destructive single twister in hit-tory ripped its way across Missouri, Illinois, and Indiana in March, 1925. It killed 695 people, injured 2.027, and destroyed property worth \$16,500,000. Usually, the path of a tornado extends for no more than twenty-five miles and the average width of its destructive swath is about 440 yards. Often the tip of its spinning cone jumps and skips along the ground bringing destruction where it touches and leaving unscathed what it passes over.

In Massouri, not long ago, a tornado circled a barn, tearing up great trees on all sides of it but leaving the building unharmed. On another occasion, a twister lifted a house into the air, carried it over a row of high trees and dropped it on the other side, leaving the trees standing stripped of leaves and back.

The whirling air acts as a great suction pump, and clouds of dust and debris are carried in the cone. Sometimes, ternado clouds are shaped like an hour glass, the small ends of two cones meeting in midair. Usually, however, they have the form of a single funnel. It may be either light colored, inky black, or hvid green. Often its approach can be heard for miles, the sound resembling the roar of a train crossing a steel bridge.

Almost always, these terrors come in the afternoon between three and five o'clock, Although the wind in the cone is gyrating at fantastic speeds, the funnel itself moves forward at a rule of between twenty-five and fifty miles an hour. An express train or an automobile, traveling in the same direction, could keep ahead of it.

Throughout the United States, the average number of tornadoes is about 100 a year. The old idea that twisters never strike twice in the same place is upset by statistics. In fact, one unlucky village in Western Kansas was hit by a tornado on the same day of the same month, at almost exactly the same hour, for three years in succession l

WHEN objects ride aloft in the grip of tornado winds, the unbelievable becomes the commonplace. Chickens have sailed through the air for more than a mile and landed stripped of all their feathers. Sheep have been shorn of their wool. Lumber wagons have been left with the spokes torn out of the wheels. Potted geraniums have been carried through the sky for three-quarters of a mile and left on the ground uninjured. And, in one southern state, a basket, containing fifty pounds of books, rode a cyclone for two miles and was found hanging on the limb of a tree with all the books intact!

Even more weird was a sight reported by reliable witnesses in a western state. During a tornado there, a horse and buggy were lifted bodily into the air and sent sailing through the sky 100 feet from the ground!

Thus, the passengers of the wind run the gamut from horses and buggies at one extreme to pollen grains drifting on lazy summer breezes at the other. In between, are a host of curious, unexpected, surprising voyagers that ride the columns of invisible all above the surface of the earth.



Hurled like a lance by a tornado, this heavy beam stuck is the clapboard pillar of a house

IT'S THE MOST TALKED ABOUT OIL IN AMERICA!

This Revolutionary New Summer Mobiloil

Enables you to drive farther and faster...yet use less oil

Do you nelleve that most motor oils are pretty much alike? Then consider these facts:

The new Summer Mobiloil was tested with another large-selling oil,

First, for consumption. Mobileil showed 98% resistance...the second motor oil, 88%.

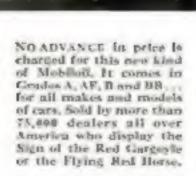
Then gumming, Mobiloil scored 100% resistance... Oil Two, 68%

Finally resistance to thinning was tested. Mobiloil registered 100 plus ...its competitor, 38!

Here is the scientific reason for this improvement; The Clearosol Process cleanses crude oils of impurities that have always resisted refining!

You buy oil anyway. Why not get the benefit of this new Mobiloil?

SOCONY-VACUUM OIL CO., INC.



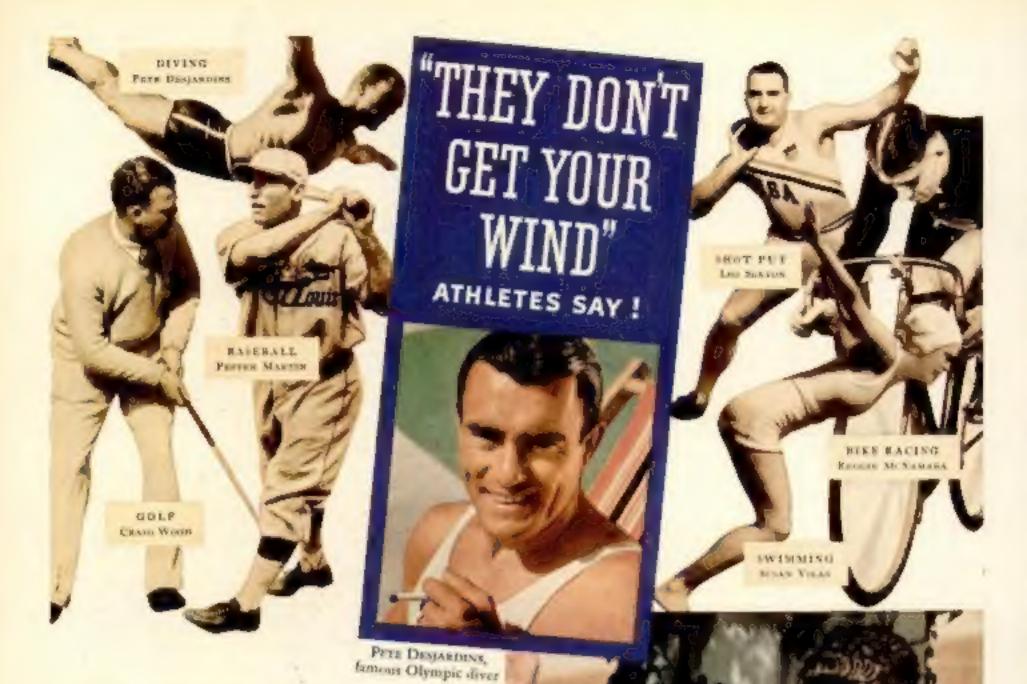
Mobiloil



100 troutes on ordinary oil stuck pistons with gum. The photo below shows how to good this danger.



100 morks on new Mobiloit ... plsturs were clean. This new kind of motor oil is practically 100% pure.



There's more pleasure in this mild cigarette...approved by athletes!

When athletes in all leading sports agree upon one cigarette, its mildness is placed beyond question.

Pete Desjardins, famous Olympic diver, says: "Camels are so mild that I can smoke as many as I like and still keep my wind in perfect condition."

Pepper Martin, fleet-footed St. Louis Cardinal, says; "Camels are mild-don't cut down my speed or wind."

Reggie McNamara, "Iron Man" bike racer, adds: "I've smoked Camels for ten years — showing that Camels don't get the wind." And Reggie is backed up by Leo Sexron, Olympic shot put record holder; Craig Wood, the golf star; and Susan Vilas, of swimming fame!

More enjoyment for you in this mild cigarette!

You'll find you can smoke Camels all you want! For athleres say that Camel's costlier tobaccos don't tire their taste—don't upset their nerves or get their "wind,"





thampion. Camels, with their costlier tobaccos, never upset your nerves. And remember—arhietes say "Camels never get your wind!"

Camels COSTLIER TOBACCOS!

Camels are made from finer, MORE EXPENSIVE TOBACCOS
 Turkish and Domestic—than any other popular brand.

(SOME) R. J. REYNOLDS TORACCO COMPANY, WINGTON SALIM, N. C.